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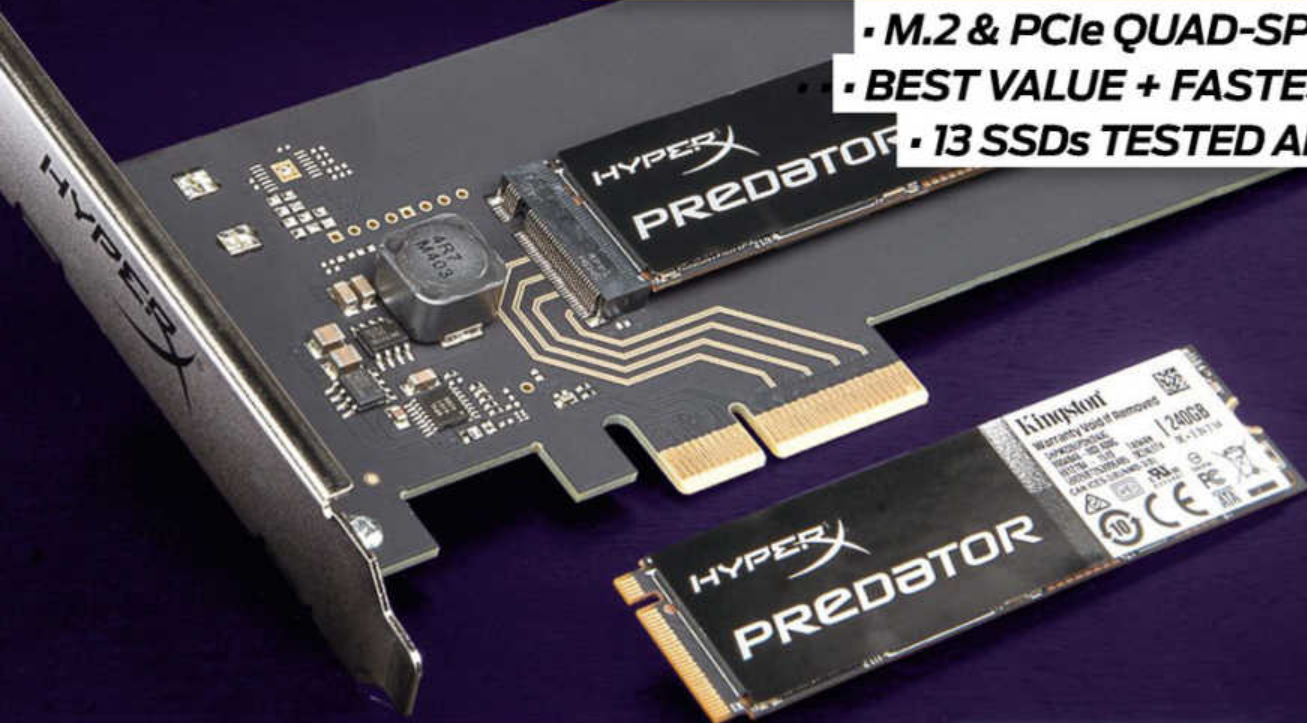
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IDLE TIME

is for playing properly

I hope you're reading this issue of PC & Tech Authority somewhere really nice, it being the summer holiday season, after all. As I type, we're an afternoon away from our own holidays. So, yes, we're feeling pretty good here at the office!

As much as I'd love to say (again!) "get outside and leave the tech behind" – and I shall – there's a small pile of boxes nearby, the contents of which I'm keen to have a play with over the next fortnight of idle time. There are goodies that the others in the team have had a longer play with than I, but, being editor and all, I really do need to familiarise myself with. In one is a Surface Book. Having just gone through Mr Agius' review (page 34) I'm keener than ever. I was at the official launch but that was a short hour of playing with it in a room full of clinking glasses, mostly. It's not often a truly innovative machine comes along and this is clearly one such piece of seismic technology.

I'll try and find some time for the iPad Pro, but honestly there's just not that much to be excited about. It doesn't fill any niche that isn't already well catered for. Perhaps for people who buy new tech rarely and have old gear that needs replacing, then yes, it's a decent Surface-style device, but there are better tablets and there are better laptops, so why bother?

Acer's sent over a 28-inch 4K G-Sync monitor for review, so that's going straight home for the gaming holiday fortnight. It's only a TN screen, where IPS rules the gaming world, but 4K at G-Sync at ultra-fluid frame rates? Yes please!

Speaking of playing Fallout 4 non-stop for a week. Maybe two. Or longer... are you? I would assume so, if you're like, well, everybody else.

What a phenomenon this game has been. Is it the feeling of a truly open sandbox world? That's a big part of the appeal. You can fire the game up and just explore, meeting the well formed characters, marvelling at the convincing wreckage of a civilisation and discovering hidden cool bits. You can soak up the luscious graphics, and tweak away to find that perfect compromise between speed and pretties. And when the need for order takes hold, steer back onto the storyline missions for a bit of completionist satisfaction.

Or I'll just be playing War Thunder, to which I'm hopelessly addicted. Try it out, it's free, and if you love WW2-era planes or tanks it's – IMHO – a better game than World of Tanks, and certainly World of Planes.

I wonder what amazing things 2016 will bring us? The team's collective eyes are gazing forward, and we're ready to tear open boxes, benchtest to the bejesus and write til our fingers are flat nubs.

Happy new year, everyone!



Ben Mansill
Editor

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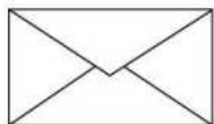


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INBOX

Rage against the machine

SOME REACTIONS TO 'THE DESTRUCTION OF THE NBN'

(www.pcauthority.com.au/Feature/412733,analysis-the-destruction-of-the-nbn.aspx)

DODGY AND DEVIOUS

I have just moved into a new apartment block in the centre of Perth. This building was advertised as being equipped with super-fast NBN. I left my old apartment in Subiaco where I had been on Cable (ex-Foxtel) with Telstra and getting around 115 mbps.

Upon arrival, my new NBN was switched on with great fanfare. 15 mbps! I was shocked.

A technician arrived and quickly worked out that the problem was the new NBN wireless modem which plugs into the NBN outlet. It had been placed in the apartment store room along with the other electrical outlets. The new modem was unable, by Wi-Fi, to travel the necessary 10 meters to my computer. The only solution was to hard wire via a junction box (\$40), and about seven meters of cable (\$32), round the skirting to my two computers. The speed is now 95mbps. But not the 115 I was getting with Cable. Mr Broadband - aka the goanna's brief! - will be hung for this dodgy devious piece of work. Remember Howard already sold something the country owned, and now they want to sell it again!

Compare this to the Singapore experience?

unwired

ADVANTAGE, CITY SLICKERS

NBN may not be faster than the Labour government's plan, but it will be faster than the current crap Regional Telstra network which is poorly maintained by a company which only cares about the

money in the pockets and not the people paying craploads to access it.

Regional areas are currently caught paying Telstra, Yes Optus and Vodafone \$10 per GB over mobile 3G and if you are lucky 4G networks because there are no other services available. NBN may not be your dream but it is definitely not your nightmare! You're probably city slickers who can already get 10s of MB/s in data speeds over the Metropolitan Telstra network you call bad!

J McInnes

DENSITY

A serious issue is the effort to rollout NBN to new developments on the outskirts of cities, rather than building them from the centre out. This took resources from central development, thereby slowing its expansion and reducing future income. How does it slow income? Simply because more central housing is denser. Once again the construction giants wanted a piece of the action and convinced everyone that putting NBN in their locations would be cheaper.

There is a reason private telcos invest in central areas well before the outskirts... doesn't take a genius to work out.

J Reid

Ben Mansill replies: *Anyone interested in the NBN should check out this developing story. The conversation in our comments section is enlightening, showing just how deeply Australians feel about the NBN issue. We've also been contacted by NBN Co and will update the story following an interview, or publish a new feature if there's enough to warrant that.*

PASSWORD SECURITY

I've been using KeePass for years now. My method is to keep the database in Dropbox, but to require a Key File (as

well as the master password) for access, which only exists on the machines that I use (plus a copy in a TrueCrypt volume on a USB stick that I carry around). I feel this is an adequate level of password security.

Unca Chris

BATTLEFRONT DISAPPOINTMENT

Had EA literally made a modern remake of Battlefront II, it'd have been a massive hit - single player campaign and multiplayer as well. It's a winning formula and would have pleased the fan base.

I'm a devout Star Wars fan, but "Star Wars, for the sake of Star Wars" just isn't enough for me to drop the money on it. Plus, completely avoiding space combat (I mean, c'mon, its "Star" Wars, i.e. outer space!) and the massive battles of the Clone Wars was extremely disappointing. Again, something that was covered in Battlefront II.

Then, for them to ask another \$50 for DLC on top of a \$60 priced game, when its obviously already completed, is egregious. I refuse to give EA my money for half a product, especially when there are other products that provide so much more bang for the buck (i.e. Fallout 4).

A friend of mine didn't look at the reviews when it came out and bought it immediately. After 4-5 hrs of play, he was bored. In literally less than one week, he had already traded it in to Gamestop and was lamenting the "waste of money" that Battlefront is.

If you're a console gamer, Battlefront is a Redbox rental at best. If you do PC... just avoid and bask in the glory of the upcoming Steam Winter Sale.

Robb

David Hollingworth replies: *I have to agree. I know some people are enjoying the game, but to me it just doesn't have any character - despite it looking superb!*

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TECH NEWS

The latest trends and products in the world of technology

TABLET CRASH: WHAT WILL HAPPEN NEXT

Tablet sales have been in decline for some time. Are slates heading the same way as netbooks? **Stuart Andrews** investigates

There's no doubt that tablet sales are now in the doldrums. Recent research from IDC claims that tablet sales have fallen 7% between the second quarter of 2014 and the same period this year. That statistic is echoed by research from Forrester that suggests the global tablet market has plateaued. Furthermore, a July report from ABI Research puts tablet sales in the first quarter of 2015 down 13% on sales in Q1 2014.

The two market leaders, Apple and Samsung, are struggling most: iPad sales are down 17.9% and Samsung tablet sales down 12%, according to IDC. ABI says the big boys are being hit even harder than that, claiming a 23% decline for iPads and a 30% decline for Samsung. On the other hand, some of the smaller players are growing. Tablets from Lenovo, LG and Huawei are all doing well by competing hard on price.

That said, the signs are worrying. Is the tablet dying, or is the hype just dying down, leaving the tablet to find its natural level?

WHY ARE TABLETS STRUGGLING?

When the iPad emerged in 2010, tablets were widely seen as the disruptive force that would herald a post-PC world. By 2011, analysts from Gartner, Forrester and IDC predicted massive sales, with the more excitable

ones predicting that tablet sales would eclipse laptop sales by 2015. However, while PC sales remain weak, tablet sales have since fallen into decline. Apple's earnings call for fiscal Q3 2015 showed that the revenue from the iPad business was lower than revenue from the Mac business – the first quarter in several years where this was the case. So why has the tablet seemingly fizzled out?

Analysts generally put it down to three core factors.

1. INNOVATION HAS STALLED

For the first few years after the iPad arrived, manufacturers went into overdrive in an attempt to outdo the competition with new designs, high-performance components and features. Apple, Samsung, Sony and Amazon brought Retina or Full HD screens into

play. Devices became slimmer, with the iPad thinning from 13mm to 7.4mm with the iPad Air. Microsoft's Surface and Surface Pro had click-in keyboards and kickstands, while Samsung brought in the stylus with the Galaxy Note. Processors moved on from dual-core processors with a basic GPU to quad-core and octa-core processors with the kind of GPU that could have powered a last-generation games console.

However, tablet innovation has now stalled. Screens can't reach higher resolutions without getting bigger or the differences becoming imperceptible. The battery size and need for strong construction make it impossible to become noticeably thinner or lighter. Features such as a stylus or split-screen app view are useful to some, but irrelevant to others. While new processors with even more powerful GPUs are coming on line, there's a dearth of software that really makes use of them. You need high-performance GPUs to play the next Infinity Blade, Dead Trigger 2 or Real Racing 3, but tablet users are primarily casual gamers, more interested in the next Angry Birds or Clash of Clans. These don't require new hardware.

As JP Gownder says in Forrester's "Global Tablet Forecast 2015 to 2018": "The iPad Air 2 compares favourably to earlier generations of iPads: it's thinner, lighter, has a better battery life and boasts a somewhat faster Wi-Fi connection, but are these incremental features enough to entice buyers to spend \$699 to \$959 to replace a still-functional older iPad?"

Hubert Joly, CEO of the US electronics chain Best Buy, made the same point in a recent interview: "The issue has been that, once you have a tablet of a certain generation, it isn't clear that you have to



➤ Battery size and the need for strong construction make it difficult for tablets to go lighter

“New processors have more powerful GPUs, but there’s a dearth of software that makes the most of them”



move on to the next generation.” That leads us on neatly to our next factor.

2. USERS AREN'T REPLACING TABLETS

That's partly because there's no compelling reason to upgrade, and partly because tablets are so robust. A tablet's product lifetime seems to be much longer than that of a smartphone. This was a point made by Apple CEO Tim Cook in an earnings call this summer: “The upgrade cycle is longer,” he said of the iPad. “It's longer than an iPhone, probably between an iPhone and a PC. We haven't been in business long enough to say that with certainty, but that's what we think.” Gartner research director Ranjit Atwal concurs: “The lifetime of tablets is being extended – they are shared out among family members – and software upgrades, especially for iOS devices, keep the tablets current,” he said in a recent report.

3 THEY'RE UNDER PRESSURE FROM PHABLETS

Just about everyone agrees that tablets are struggling to compete with big-screen phones, and that 7-8in devices are particularly affected. After all, if

you're packing a Samsung Galaxy Note 4, an iPhone 6 Plus or a Google Nexus 6, where's the value in carrying around a slightly larger tablet too? “Users of tablets with a screen size between seven and eight inches are increasingly not replacing their devices,” suggested Gartner research director Annette Zimmerman.

In fact, a June 2015 Gartner survey found that 44% of current tablet users were planning to substitute their tablets with another device. “A consumer owning a large smartphone wouldn't see the point in renewing or purchasing a slightly larger device with very similar functionalities,” said IDC analyst Marta Fiorentini. “In fact, smartphones have additional voice capabilities

and sometimes better cameras or resolution.”

REASONS TO BE CHEERFUL

It seems that tablets have little chance against this triple threat, but that doesn't mean that they're in terminal decline either. Longer refresh cycles might mean lower sales, but consumers are still using their tablets and may one day want to replace them. They continue to be a hit with families, too – no other device is as handy, accessible and inexpensive enough to share with your kids.

What's more, tablet use is growing in the business sector. Forrester's research shows that more than half of employees are now using tablets for business at least once a week, often in those situations – while in transit, standing, or for specific workflows – where a laptop isn't such a good fit. And while these workers are bringing their own devices to work under so-called Bring Your Own Device (BYOD) schemes, company-purchased tablets are making up an increasing portion of the market. Expect to see this accelerated by the growth of business-class devices, which was kickstarted by Microsoft with the Surface Pro, but has now been adopted by manufacturers such as Apple, HP, Dell and Samsung. Despite bigger screens and multitasking capabilities, these are still tablets, but the addition of clip-on keyboards or a stylus makes them more versatile productivity devices.

Innovation also has a part to play. We may have seen all the tablet can offer in terms of screen resolution and physical design, but there's still potential for new power-hungry applications to come along, while 3D depth-sensing technologies, such as Intel's RealSense cameras and Google's Project Tango, could revitalise interest in tablets. The hype might be dying down, but the tablet isn't dead. It's no laptop killer, but it has its own niche to fill. ●



Google's Project Tango could help revitalise the tablet market

GAMING NEWS

For the fun

WINNERS FROM THE GAME AWARDS 2015

The Witcher 3 and Splatoon among others are big winners this year, alongside a varied spread of AAA and indie titles for the Games Awards

The Game Awards have had some amazing games and people awarded for their contribution to gaming in 2015. The Witcher 3 was announced as the Game of The Year and best RPG, beating Super Mario Maker, Fallout 4, Bloodborne, and Metal Gear Solid V. MGSV was awarded both best soundtrack and best Action/adventure, although the latter was accepted by Kiefer Sutherland on Hideo Kojima's behalf, due to Konami barring him entrance.

Nintendo was also quite successful this year, winning best shooter and best multiplayer with Splatoon, and best family game with Super Mario Maker. Some indie titles were given exposure with their winnings, Rocket League winning best indie title and racing/sports

game, and Ori and the Blind Forest netting best art direction.

Despite its success upon release, Fallout 4 did not receive any of its four nominated awards, nor its mobile counterpart Fallout Shelter. Bloodborne was similarly missing from the winner's pool, missing out on three nominations.



NEW STEAM AUTHENTICATOR LEAVES USERS FUMING

Many Steam users, specifically those involved in Team Fortress 2 and Counter-Strike: Global Offensive, have been left furious over the introduction of the Steam Mobile Authenticator. The new system was billed to add a new level of security to trading which is very active for both communities.

The new trade system requires both parties have the Authenticator, and if one doesn't, both items become unavailable until the app is acquired, and if the pending trade is cancelled, the account receives a trade ban for an unspecified number of days.

BIG ANNOUNCEMENTS AND RUMOURS FOR FINAL FANTASY

Satoshi Kitade, one of Square Enix's programmers working on Final Fantasy XV has said the game is now playable from start to finish, with the first half working with final product quality.

After nearly a decade of waiting, Final Fantasy fans have endured a change in Director, from Kingdom Hearts director Tetsuya Nomura to Hajime Tabata, who has previously worked on Final Fantasy spin-off titles

such as Type-0, which recently had a HD port released for current generation. The game also began as a spin-off of the 13th game, but has since grown to its numbered title.



This news also coincides with new titles coming to Steam being leaked, among which are many Sony games such as Danganronpa 1 and 2, Steins; Gate, Guilty Gear Xrd -Sign-, and Final Fantasy X/X2 HD, which will be the 10th numbered Final Fantasy game on PC, leaving only four of the numbered titles to be added to the steam library.

NX PATENT INFORMATION REVEALED

A new patent application from Nintendo has revealed more about their new console, specifically the ability to "couple to a supplemental computing device" that may boost the game's performance, or simply store extra information.

Storing game data through an external device is nothing new for consoles, however having supplemental devices for performance is a first since the Memory Pak of the Nintendo 64 which bolstered the system's RAM to 8MB. The patent details the supplementary device, which means users will likely need to purchase the peripheral from Nintendo.

The application was filed just a few days before the release of Nintendo's most ambitious game yet for the WiiU, Xenoblade Chronicles X, in terms of map size. This came as well with a recommendation to download in excess of 10GB to help the system cope with loading the immense landscape.

THEIR EVOLUTION



CHIP NEWS

Intel joins in with Apple's bend-gate, Tonga has a big bus it doesn't use and Intel brings out a consumer decuple-cored CPU. **Mark Williams** checks out the latest in chip news

CPU

BROADWELL-E SPECS APPEAR

The specifications for Intel's coming refresh to Haswell-E, the current High End Desk Top (HEDT) CPU range, have leaked and there is a pleasant surprise or two.

Not only will the new Broadwell-E CPUs be faster across the board but there will also be (slightly) more of them.

Currently Haswell-E comes in just three versions: the i7-5960X (8 cores @ 3GHz), i7-5930K (6 cores @ 3.5GHz) and the i7-5820K (6 cores @ 3.3GHz).

Broadwell-E will be seen in four CPUs flavours: the i7-6900K (8 cores @ 3.3GHz), i7-6850K (6 cores @ 3.6GHz), i7-6800K (6 cores @ 3.4GHz) and for the first time to the consumer market a ten core CPU called the i7-6950X (10 cores @ 3GHz).

It seems that the shrink down to 14nm has allowed Intel to cram in two whole extra cores into the package!

While the six-cored iterations seem to simply give a 100MHz bump in base and turbo clocks the eight core variant sees a nice 200-300MHz bump in clock speeds.

There's no word yet if Intel will be crippling the number of PCI-E lanes on

the lower end chips like they did to the 5820K. Something to keep an ear to the ground for if considering them.

INTEL CPUS BENDING

Thanks to smarter wiring in the SOC, Intel's latest Skylake CPUs were noted for having markedly slimmer substrates compared to Broadwell. This however leads to one unfortunate reality, those new substrates aren't as physically strong as the old thicker ones.

As a result it has been found that some third party heatsinks, notably from Scythe with its HPMS mounting

system, can actually bend the substrate out of shape as well as the pins in the motherboard socket itself due to too much pressure being applied to the mount.

Intel has come out saying the guideline specifications for heatsinks hasn't changed from its last generation of CPUs, so it would seem a few third party suppliers may have been relying on the previous thicker substrate to allow tighter mountings to give better performance.

▼ A Skylake CPU, bent out of shape by a tight HSF mounting



PHOTO: www.pcgameshardware.de

GPU

TONGA HAS A BIG BUS

After much speculation that AMD's Tonga GPU chip secretly had a wider 384-bit memory bus inside, it has turned out to be true.

Since the surprise of the recent R9 380X launch using a regular 256bit bus, AMD's vice president of its Radeon graphics group Raja Kadoori confirmed that Tonga does indeed have a 384bit memory bus on chip, however due to how tight the market is AMD couldn't find a good price/performance gap to slot such a product into.

Doing so would've made 3GB/6GB VRAM models possible which would have upped the price of such a card into territory other cards already inhabit in the market.

So it seems we'll never get to see a true Tonga XT chip come to market. C'est la vie.

BUNGLED DRIVERS

This month saw a few driver bungles from both GPU camps. The more serious of the two was with the launch of AMD's new Crimson driver, which unintentionally left some AMD owners with cards that wouldn't spin up their fans to cool down the cards properly, leaving a small few with busted cards. AMD however quickly released a driver hotfix to rectify this issue.

Not to be outdone, Nvidia botched an update when it released drivers for Fallout 4 and Call of Duty: Black Ops 3 leaving users with some mobile GPUs completely unable to play any games. Requiring a complete uninstall of the drivers and to temporarily revert back to a previous release.

GTX 750 GETS NEW LIFE

Based on the GM107 chip sporting

what could be called the Maxwell 1.0 architecture, the GTX 750 has proven popular enough even today that Nvidia have had to recreate it from current gen chips as they're stopping production of the GM107.

The new GTX 750 will basically be a Maxwell 2.0 sporting GM206 chip of GTX 950 fame but cut down further to match the GTX 750's original CUDA count of 512 shaders.

The updated Maxwell 2.0 architecture brings along some extra features the original GTX 750 lacked, such as 4k video encoding support and full fixed function HEVC hardware based decoding.

These newly updated models should be trickling through to retailers as we speak, though it's uncertain at this stage how to tell the difference between the old and new versions just by looking at the box.

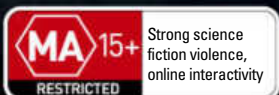
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XCOM 2

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MOST WANTED

Find out what's good, what's not, and what **Rob North** liked a lot

Phanteks Enthoo Mini XL Dual System Chassis

It's often said that two is better than one. But if, for whatever reason, you're contemplating setting up two separate PCs the idea of assembling two systems is probably prompting fears of a hot mess of cabling, and a dire lack of remaining floor or desk space. But with Phanteks' Enthoo Mini XL Dual System, as the name suggests, you'll be able to cram those two systems into the one case with ease.

MOST WANTED: Pre-installed with the company's innovative power splitter, the case can support two motherboards (either microATX or miniITX) that can be powered using the one power supply – and if your PSU can handle it, you can even run them simultaneously.

NOT WANTED: It's a neat idea and great to see Phanteks bundle up their power splitter with a case, but unless you're into gameplay streaming and want to decrease lag, we can't see much use for this novel bad boy.



Ulo Home Security Camera

Featuring a cute and discrete design, Ulo is a home security camera that looks more cartoon owl than home surveillance, making it perfect for parents who want to keep a watchful eye when away from the house without weirding out the children.

MOST WANTED: Equipped with a motion sensor and night-vision camera hidden behind the mirror beak and two round LCD screen eyes, Ulo uses eye expressions to communicate what it's up to – it'll blink when a picture is taken via a connected smartphone app, squint when someone is watching live-feed, and get sleepy when it's running low on battery. And if you activate the alert mode it'll record all motion and send you an animated GIF via email.

NOT WANTED: It's perfect as a baby monitor or for helicopter parents, but given that it's hard to identify as a security camera it'll probably do little to deter burglars from entering your home.



Asus Chromebit

Looking for a micro-computer that's a little more ready-to-rock than the Raspberry Pi Zero? Asus' simple dongle-like Chrome OS device – announced way back in mid-2015 – might just be what you're looking for.

MOST WANTED: The pocket-sized Chromebit will let you turn any display into a Chrome OS device, with a Rockchip Quad-Core RK3288C Processor, 2GB of RAM and 16GB eMMC storage. Best of all it's relatively affordable at just \$149 locally.

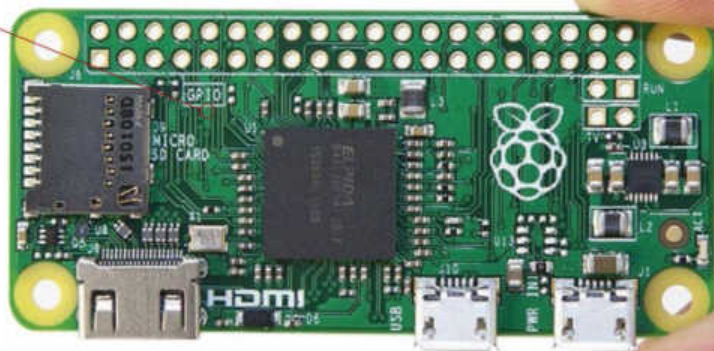
NOT WANTED: Unfortunately the Chromebit lacks an internal battery, severely limiting its potential as a cheap travel computer. And if you were thinking it'd be perfect streaming solution for your living room why not go with the far cheaper Google Chromecast?

Raspberry Pi Zero

If you needed any further proof that we're living in the damn future, look no further than the Raspberry Pi Foundation's latest micro-computer: so small and so cheap that it was given away for free with issue 40 of the UK-based charity's official magazine The Mag Pi.

MOST WANTED: Otherwise available for \$US5 and measuring just 6.5cm x 3cm, the Raspberry Pi Zero is a powerhouse for its price and size. It's got a 1GHz processor and 512MB of ram, alongside a micro-SD card slot, micro-USB slots, a mini-HDMI port and a HAT-compatible 40-pin header.

NOT WANTED: Granted some sacrifices have been made - namely the lack of an Ethernet port - and you'll need a few adaptors for most input and output devices. But that's all part of the fun, right? Plus, thanks to the small number available at launch and high demand they'll be a little difficult to get your hands on for the time being.



Anova Precision Cooker - Bluetooth + Wi-Fi

Once the domain of the professional chef or the loaded kitchen-nerd, sous-vide cooking is slowly taking off thanks to awesome affordable devices like Anova's Precision Cooker. If you're not familiar with sous-vide, it's a method in which you pop your food in a sealed bag, immerse it in heated water and slow cook it to moist perfection. And oh-boy can Anova's device make for some delicious meals.

MOST WANTED: An updated version of an earlier Bluetooth model, the Wi-Fi enabled model is like a big heating wand that clips to the side of your pan or pot, with a thermometer and water circulator inside and two LCD screens on top with readouts of the current water temperature, your set temperature, and a timer.

NOT WANTED: If you already have the earlier model you probably won't be in a rush to upgrade, as there are next to no added features aside from Wi-Fi.



Drift TV

Chilling out in front of the idiot box can be a great way to unwind just before bed. Unfortunately as you may have heard this relaxing habit can lead to a bad night's sleep. Enter Drift TV - the must have hardware for those looking to enjoy late night channel surfing without compromising sleep.

MOST WANTED: Connected to the telly via HDMI, Drift TV reduces the display's blue light, which is essentially the worst offender in the light spectrum when it comes to your sleep. It can be scheduled to reduce the blue light at night, instantly or gradually over time, and can be configured to return your TV to the full colour spectrum during the daytime.

NOT WANTED: Of course if you're happy watching TV on your PC you may as well pick up the popular and free F.lux instead. Alternatively you could switch off your PC and enjoy reading your favourite mag, eh?



Corsair Hydro Series H5 SF

When Corsair announced the Bulldog, its living-room PC kit and chassis, it was a big statement of support for high-end small-form-factor gaming PCs. Now they're following up their love for mini-ITX builders with the independent release of the Bulldog's pint-sized closed loop liquid CPU cooler so you can cram it into your very own existing or future build.

MOST WANTED: Corsair's cooler is a big leap forward, putting us one step closer to a place where we won't need to sacrifice on performance with our mini-ITX builds anymore. Measuring 167 x 40 x 57mm, with an overall height of 84mm, it'll squeeze into a tight space with a 120mm fan that spins between 1,000 and 1,800 RPM.

NOT WANTED: Corsair record a fan noise level of 36 - 42 dB(A) so it's not exactly the quietest cooler in the world, but given its size and performance we can probably deal with the slight whir in this instance.



System news

THIS MONTH **MARK WILLIAMS** LOOKS AT NUC AND SFF COMPUTERS TO SEE JUST HOW FAR THEY'VE COME AND WHERE THEY'RE HEADING

Originally, Small Form Factor (SFF) PCs were anything with a mini ITX motherboard inside a case no bigger than a shoebox. But as chip technology advanced we saw the rise of netbooks (Eee PC anyone?) and nettops, both of which were made possible by the introduction of the low power Intel Atom processor in 2008.

While they did as their name advertised, providing cheap internet capable PCs, they were still quite hamstrung in many ways. One being that SSDs had not yet appeared to the general masses yet making for some painfully slow load times if you were unfortunate enough to be stuck with a 1.8-inch internal HDD, and the single- or dual-core non-threaded Atoms of the day were so underpowered they struggled to even play YouTube videos smoothly.

Fast forward to when Intel launched its Next Unit of Computing (NUC) platform in 2013, it reinvigorated the SFF market. Thanks to technology advances, particularly in IPC and power consumption, for the first time Intel were offering CPUs with full fat desktop class performance that still could fit and operate within the same thermal, power and size limitations of its early nettop forebears, but without the restrictions that the Atom architectures single minded focus on power savings had. This new ultra-low power class of CPU finally gave us the benefits of both worlds, very respectable performance that fits into the volume equivalent of four decks of playing cards, or even less.

So respectable is the performance of SFF PCs today they can do just about anything you might want them to, and quite capable of replacing full sized desktop machines of just a few years ago. It even spawned a new class of gaming console under Valve's Steam Machine initiative.

Certainly the buzz and hype for this class of PC has worn off since the



novelty heights of when netbooks and nettops first appeared, however according to those in the industry, SFF systems are still making up around 15% of system sales which isn't too shabby when you consider the typically niche use cases for these systems.

Intel continue to push the boundaries of where they can take x86 next though. A few months ago introducing the Intel Compute Stick which looks like an oversized USB flash drive, except it's an Atom class PC that you plug directly into any HDMI port instantly turning any regular TV into a smart TV.

With HBM memory around the corner for CPU's, further integrating features into SoCs, shrinking them further, the SFF class of PC is only going to get more and more powerful as time goes on.

Speaking of the future, news is starting to leak out regarding Intel's next generation NUC platform dubbed Skull Canyon. Due out in the first quarter of 2016 the new NUC platform will offer up the new Skylake architecture for these systems and more intriguingly will also bring Iris Pro graphics to the table which will give it some quite respectable gaming chops. This could be viewed as Intel covering off AMD's future Zen based APUs due later on in the year which no doubt will have solid gaming performance too but if AMD can match Intel's CPU performance it will create some solid competition, which us the consumers will be the winners from.



SHOP TALK

Are NUCs a popular choice for customers? Given the continuing miniaturization of components, do you think NUC class PCs could eventually overtake ATX PCs in sales volume?

John, TI Computers:

Yes, the sale of these SFF PCs has started to take off this year, especially in specific commercial projects, where size matters more than processing performance, not to mention they also tend to deliver less noise and power consumption than non-optimized DIY systems.

Despite seeing vendors such as Asus starting to bring out SFF PCs based on desktop processors (such as VivoMini-V VC65R) bringing full size performance in such a small footprint, while they are also neat and can fit into most applications. We still do not see the likelihood of them replacing custom PCs in consumer market any time soon due to two distinct reasons; versatility and customizability. As you know, a closed system like SFF PCs are limited what is offered by vendor specification, whether that is the selection of processor, connectivity, storage options and feature sets. There is no chance to cater a better spec'd system for our clients if such combination is not offered by vendors, making us believe they are neat solutions, however, are not yet able to replace the position of custom systems in the consumer market.

Scott, PC Case Gear:

NUCs and Intel Compute Sticks have certainly been a sales success, but we are finding they are more often than not purchased as an addition to the main gaming rig rather than a replacement. Our market demands the latest in performance, and as such I don't see NUC class PCs presenting a threat to full gaming systems for some time to come.

Michael, Aus PC Market:

We're finding more customers are choosing mini PCs with embedded CPU performance, eg Atom, these days, over the NUCs with discrete CPUs. I'm guessing it's partly because the cost of building an entire desktop PC, with Windows 10 included, can be \$260 or so. These are so low-powered they can be left always-on without incurring a big electricity bill, and as such they lend themselves well to being used as media centres - they don't need much heat-sinking or make any noise either, and I've even found them in keyboards now.

Market snapshot

A SAMPLING OF NUC AND SFF SYSTEMS AVAILABLE THIS MONTH

ULTIMATE LIVING ROOM PC

PC Case Gear ASUS ROG GR6

\$939 · www.pccasegear.com/products/33960

Originally designed for the launch of SteamOS (hence the dedicated Steam button), Asus has taken to selling this as a straight up Windows PC, loaded with Win8.1 (which you can upgrade for free to Win10).

The gaming heritage of this not so small SFF PC is obvious with its dedicated GTX 960M graphics. Being a ROG branded product it also plays well to the enthusiast by having an easily accessible 2.5-inch SATA hard drive bay and SODIMM memory slots (supports up to 16GB) for easy upgrades.

For console-class performance but with the benefits that a PC brings, this is the ultimate living room PC. We just wish one of the USB3 ports was on the front.



KEY SPECS

CPU: Intel i5-5200U

Cooler: OEM

Motherboard: OEM

Graphics: Nvidia GTX 960M

Memory: None. Supports up to 16GB DDR3L 1600MHz

Storage: None. Supports up to 2x 2.5" HDD/SDD's

Power Supply: 120W

Case: OEM

YES, IT'S A PC

Aus PC Market Benton MiniPC

\$219 · <http://tinyurl.com/o87ogj3>

This unique system is interesting not only for the fact of how flat it is but because inside it also houses batteries that can sustain power for up to an hour. With the only way to power/charge this being via USB it seems well suited to being stuck to the rear of a TV that has a USB port and used as a smart TV conversion/upgrade unit.

Quite why it needs the batteries though is a bit of a riddle, as the thrifty CPU inside draws less than what USB 2.0 provides, so it's not required for peak loads, and with the need to plug it into a screen which will likely be plugged in to mains it's hard to see what the use case for this system



KEY SPECS

CPU: Intel Atom Z3735F

Cooler: Passive

Motherboard: OEM

Graphics: Integrated Intel HD Graphics

Memory: 2GB DDR3L 1333MHz

Storage: 32GB eMMC internal plus a MicroSD expansion slot

Power Supply: None. Any USB charger/port

Case: OEM

NUC NUC NUC

ARC Intel NUC

\$418 · <http://arc.com.au/product/57630>

Ahh Intel's NUC, the system that redefined the SFF segment. Although it's had a slight facelift, the NUC design still looks a little bit dated, or at the least bland.

Something which the internals somewhat reflect as well. As Skylake hasn't made its way to the NUC/SFF segment yet the 5th gen processor inside, while having been around a while, is still the latest available for this market segment.

With ample connectivity via USB3, Gbit NIC, Wi-Fi AC and sporting M.2 this will easily make a solid base for any media centre build.



KEY SPECS

CPU: Intel i3-5010U

Cooler: OEM

Motherboard: OEM

Graphics: Integrated Intel HD Graphics 5500

Memory: None. Supports up to 16GB DDR3L 1600MHz

Storage: None. Supports 1x M.2 and 1x 2.5" SATA

Power Supply: 65W

Case: OEM

PRETTY BABY

Asus VivoPC VM62N-G040M

\$599 · <http://tinyurl.com/oa3s8sw>

This sleek looking PC is a big long in the tooth, sporting a last gen CPU, but it was one of the more powerful of that generation so it actually still holds up rather well. Throw in the fact that it can house two 2.5-inch drives, has six USB ports, a multi-card reader and an audio SPDIF optical output and it's already ahead against even what many current gen NUC/SFF solutions offer.

Then there's the fact that it has inbuilt stereo speakers and an Nvidia GTX 820M powering its graphics and you have a rather capable desktop replacement on your hands, perhaps an entertainment solution or a portable presentation system.



KEY SPECS

CPU: Intel i5-4210U

Cooler: OEM

Motherboard: OEM

Graphics: Nvidia GTX 820M

Memory: None. Supports up to 16GB DDR3L 1600MHz

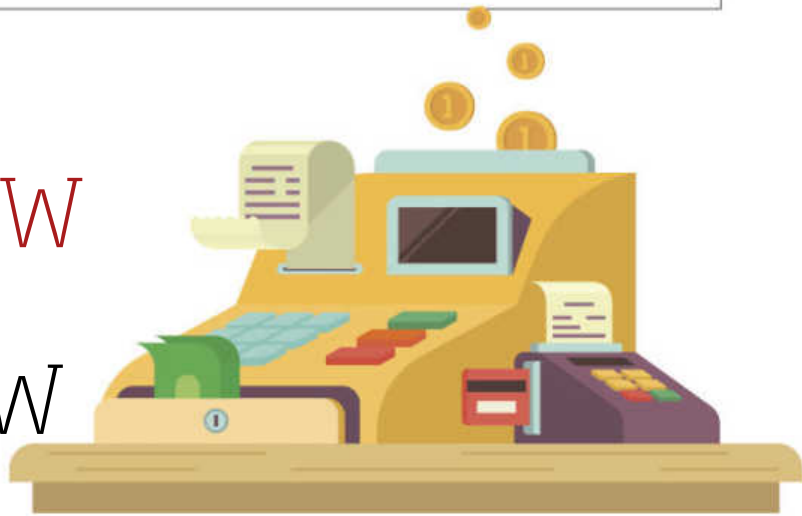
Storage: None. Supports up to 2x 2.5" HDD/SDD's

Power Supply: 65W

Case: OEM

ACCC TO REVIEW AUSTRALIAN CONSUMER LAW

Anthony Caruana on the impact upon consumer technology



We enjoy some pretty robust consumer protection law in Australia. And despite some criticisms the ACCC does a pretty reasonable job at prosecuting companies that breach those rules.

Over the years we've seen the ACCC take on Apple, MSY Technology and others over claims made regarding product capability and warranty conditions.

It's been a few years since the last sweeping changes were made to consumer protection laws when the various state consumer regulations were pulled together in 2010, resulting in simplified and harmonised rules for consumers in different states.

As well as making life better for consumers, it meant resellers and manufacturers had a more consistent environment to work in where the rules in each Australian jurisdiction were consistent.

It's what the ACCC calls their "one law, multiple regulators" model for the Australian Consumer Law. So, even though there's one consumer law, you need to contact the consumer affairs department in your state or territory when you need assistance.

Since 2010, the business environment has changed and the ACCC has recognised this. They will be kicking off a review of the Australian Consumer Law which will focus on a number of different areas.

These include the adequacy of the ACL penalty regime in delivering deterrence, the application of the ACL to the sharing economy, and challenges

around adopting trusted international product safety standards.

ACCC Chairman Rod Simms says "The general ACL provisions relating to misleading and deceptive conduct and unconscionable conduct have served us well".

We have to say, the ACCC often seems like a toothless tiger but they have managed to collect over \$44M in fines since the current regulatory regime came into place in 2010. That's with maximum fines of \$1.1M for a corporation or \$220,000 for an individual.

However, a judgement made against

"what obligations do they have to return your data should the service fail?"

Coles in 2014 regarding their conduct with suppliers began a push for the penalty regime to be reviewed.

Drip pricing, where a vendor doesn't make pricing clear at the start of a transaction and adds fees once you're deeply engaged in a transaction are also under the ACCC's spotlight. I know many of us feel gouged when we are about to make an online purchase only to get hit with transaction costs.

As always, the ACCC wants to keep a close eye on companies that act deceptively or are misleading. Using the experience they've gained over their history, the ACCC is looking to consider whether certain industries might need to be subjected to industry codes and standards. We'd like to see hardware resellers educated in their obligations when it comes to warranty claims.

For buyers of technology, it's hard to see how things will change when it comes to the purchase of software and hardware. The ACCC has already put rules in place that effectively say manufacturer warranties can be

overruled. For example, they say it's reasonable for a \$2,000 television to be repaired or replaced under warranty even after the manufacturer warranty expires given the value and expected life of the appliance.

However, we now live in a world of shared services. Many of us buy software or use services such as AirBNB, Uber and others which currently have evolving regulatory obligations as they fall outside existing frameworks.

We're hoping the ACCC looks at these closely. For example, if you're using a cloud service for storing data, what obligations do they have to return your data should the service fail? And do service providers have the right to redefine services you're paying for without consultation?

We imagine it will be very challenging for the ACCC to set rules when the customers they are trying to protect are operating in volatile markets with new entrants accessing previously unimagined services.

One of the areas in the ACCC's review is so-called 'phoenix companies' that take customers' money but, when the business is failing, shut down in order to avoid their obligations and then restart under a different name.

Governments planned this review as part of the process in developing and introducing the ACL in 2010. The review will commence in 2016. You'll be able to follow it and contribute from the ACCC's website. A final report is expected to be published in March 2017.

NEED HELP? EVER HAD AN ISSUE AS A CONSUMER? INVESTIGATOR CAN HELP.

If you've had an issue or had something happen and you think investigator could help, email your problem to investigator@pcandtechauthority.com.au



Anthony Caruana

has worked for almost every major masthead in the Australian IT press. As an experienced IT professional – having worked as the lead IT executive in several businesses, he brings a unique insight to his reporting of IT for both businesses and consumers.



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How secure is your SMART WATCH?

THE SMARTWATCH IS RAPIDLY GROWING IN POPULARITY, BUT DO WEARABLES CONSTITUTE A SERIOUS SECURITY RISK? **DAVEY WINDER** INVESTIGATES

How long does the battery last? Should I opt for Apple or Android? Can I pay for my lunch with it? The list of smartwatch FAQs has one glaring omission: how secure are the damned things?

While everyone – PC & Tech Authority included – focuses on the magnificent features and longevity of these supercharged wristwatches, it seems nobody is talking about smartwatch security. How hackable are these devices? Are they susceptible to malware? Will they divulge your personal data if they're lost or stolen? Can they even be wiped remotely?

We routinely ask such questions about our smartphones, the devices that wearables are inextricably paired with. Yet early adopters and the media – who don't normally shy away from potential scare stories – have been unusually quiet when it comes to smartwatch security. Both, it seems, have been complacent about the risks.

More than a dumb display?

One of the big hurdles that must be overcome when talking about smartwatch security is accepting that it's a genuine concern in the first place. After all, isn't the gadget on your wrist just a dumb mini-monitor for the smartphone in your pocket? That's certainly a common perception, along with the notion that, as long as the data on your smartphone is secured, the watch is of very little consequence.

The reality is rather different, as researchers from Trend Micro recently discovered when they conducted penetration testing on some of the most popular smartwatches on the market. The Apple Watch, Motorola Moto 360 and Pebble watches were among those tested for their hardware protection, data connections and local data storage. "It's clear that manufacturers have opted for convenience at the expense of security," Bharat Mistry, cybersecurity consultant at Trend Micro, told PC & Tech Authority. "We discovered that all of them saved data down locally,

which enables a hacker to access the data when the watch is taken out of range of the smartphone it's paired with."

Both Apple- and Android-powered watches store unread notifications, as well as fitness and calendar data. The Apple Watch adds images, contacts and Passbook information to the list of data stored locally. "As Passbook information can contain highly sensitive data such as plane tickets, smartwatch owners need to be as careful with these devices as they would with their smartphones," Mistry warned.

The idea that synced local data can be read through the watch interface is concerning, but the fact that the Apple Watch stores so much of it is of even more

"It's clear that manufacturers have opted for convenience at the expense of security"

troubling. Trend Micro's research exposes the misconception that smartwatches are only smart on the outside.

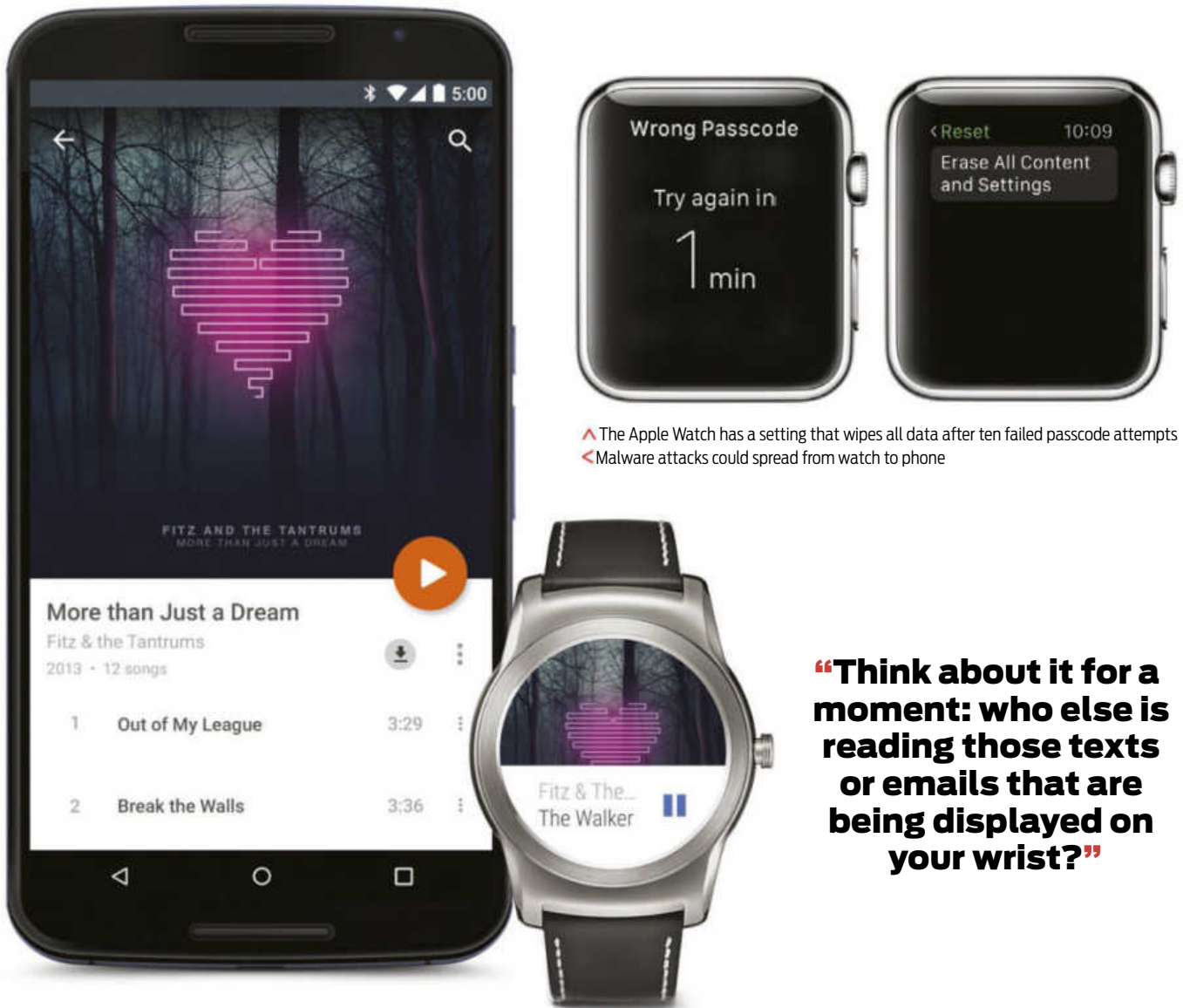
HP has also recently carried out research into smartwatch security, and the results don't make for comfortable reading. Once again, all of the tested devices contained vulnerabilities, with HP branding smartwatches "a new and open frontier for cyber-attack". HP Fortify raised particular concerns about insufficient user authentication, insecure web interfaces that potentially enable hackers to identify user accounts through password-reset mechanisms, and poor encryption of data in transit. The latter is of huge concern to those in the security business. While all the devices implemented SSL/TLS, HP found that 40% of the watches were either vulnerable to POODLE attacks (a well-known, and relatively easy to mitigate, man-in-the-middle exploit of transport encryption mechanisms) or still using old protocols such as SSL 2.0.

Simeon Coney, chief strategy officer at AdaptiveMobile, believes that the potential to ping unauthorised messages to users is a major concern. "Smartwatches compound one of the primary security risks already prevalent on mobile phones, which is that they encourage users to 'glance and respond' to notifications," he said. This means attackers can exploit this behaviour to contact the user with interactions that aren't scrutinised for legitimacy in a way that they would if they, for example, received an email on their PC. "Any interaction where the user is either not given enough information to determine its legitimacy or where the device, or ecosystem, does not provide automated security scanning before delivery could be exploited," he added.

Then there's the small matter of firmware updates being transmitted without any encryption of the transport mechanism or the update files themselves. This isn't quite so worrying, as most updates are signed to prevent malicious installs, but the lack of encryption does make for easier downloading and analysis by the crooks. It also suggests that manufacturers are guilty of concentrating on the design and features of smartwatches, at the expense of designing functional security into the devices from the get-go.

MALWARE O'CLOCK

Ken Munro, senior partner at Pen Test Partners, is a professional penetration tester and thinks part of the security problem with smartwatches is that they have evolved to run fully fledged operating systems that can connect to the internet independently. "We should expect more targeted attacks," he told PC & Tech Authority. "The apps for smartwatches tend to request every permission under the sun. If malware can be uploaded, or if a malicious app is installed on the watch, it could potentially access a lot of data."



- ▲ The Apple Watch has a setting that wipes all data after ten failed passcode attempts
- ◀ Malware attacks could spread from watch to phone

“Think about it for a moment: who else is reading those texts or emails that are being displayed on your wrist?”

Isn't the malware threat really to the phone itself rather than the wearable? Is there any evidence that smartwatches are even being targeted by malware writers, either from the standalone perspective or as a conduit to get at that valuable data stored on a paired smartphone? "Currently we are not yet seeing many attacks on smartwatches," said Jahmel Harris, information security consultant with MWR Labs, who expects attacks to become more common as users adopt mobile payment systems.

Harris added that both Google and Apple have gone to great lengths to protect against the type of attacks that would allow malware to spread from watch to phone, but warned that "applications could be installed covertly on some smartwatches that behave differently to the software running on phones, making it more challenging for security researchers to analyse malware".

What smartwatches have going in their favour, at least for now, is that they are relatively niche. In other words, they haven't

exactly become the phenomena that some had predicted and, as with all minority operating systems, the smaller the installed base, the less attractive the target.

Smartphones are much more common than smartwatches, hold more sensitive data, have greater processing power for launching attacks, and have direct connections to external networks. "It just doesn't make sense for someone to go to the trouble to target a smartwatch, when it would likely be more difficult and have less payoff than targeting the phone itself," said Chris Camejo, director at NTT Com Security. "The only scenario I could think of is a ridiculously easy-to-exploit vulnerability in a smartwatch, but any such vulnerability would likely be patched quickly."

PRIVACY ON PARADE

If malware isn't a threat to your data, maybe you are. Think about it for a moment: who else is reading those texts or emails that are being displayed on your wrist? What about two-factor authentication codes

if they pop up as alerts on the watch? Is inadvertent data sharing, also known as "shoulder surfing", likely to be a major threat to your privacy? Chris Camejo thinks that the always-on (as in physically always on your wrist) nature of the device carries a far greater risk than a smartphone, which is often kept in a bag or pocket. Much of this information, he surmises, would have greater potential for embarrassment than malicious compromise. "Two-factor codes are generally useless without another piece of information, such as a PIN, password or certificate," he explained. "While we could dream up some scenarios where shoulder-surfed data could lead to a breach, these would likely be contrived."

Bharat Mistry disagrees from a purely data-privacy perspective: "The controls on these devices are relatively immature, so there is a big risk of inadvertent data sharing," he warned. "If a user forgets to lock a device, there is the potential for other people to view notifications that pop up on their watch."



Thermaltake

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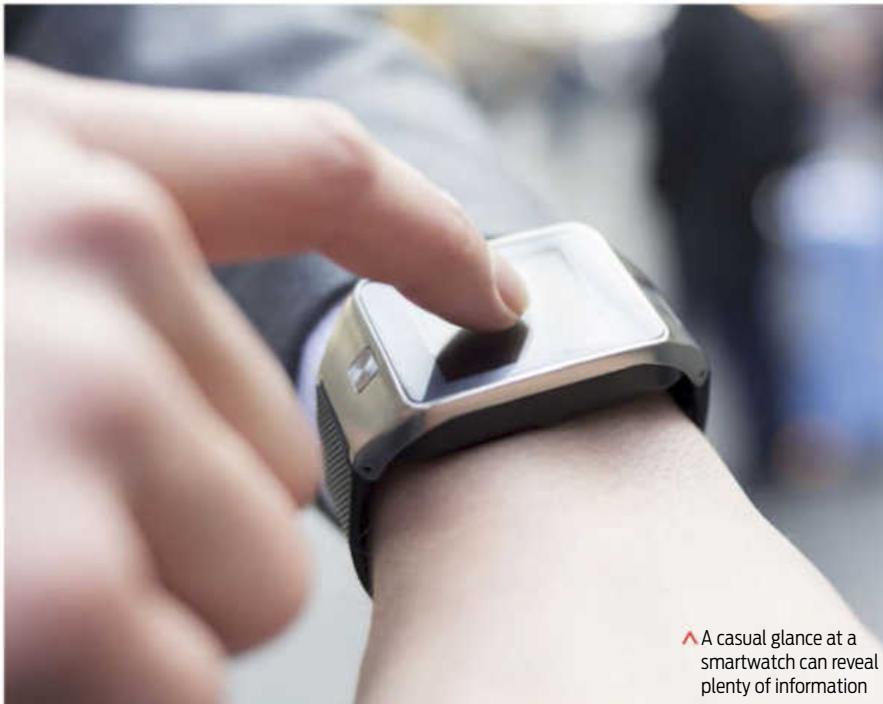
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▲ A casual glance at a smartwatch can reveal plenty of information

Indeed, the lockscreen would appear to be the best defence when it comes to preserving privacy. Android Wear, for example, is now shipped with the same lockscreen used by Lollipop smartphones, in the form of Keyguard. "Locking a phone can stop an attacker from reading messages. However, unless a lock is set on the watch, a casual glance can reveal a lot of potentially sensitive information," said MWR's Jahmel Harris.

If not through shoulder surfing, then how might data privacy be vulnerable? The synchronisation of data via Bluetooth and Wi-Fi poses another risk. "This creates an interesting attack angle, but is likely to require physical proximity to exploit a specific user," said Simeon Coney. Then again, it has become apparent that Apple's AirDrop is being used to send unwanted content to users. If this makes its way to the watch it could be used to push malicious messages or phishing "by pushing seemingly legitimate prompts for PIN codes, passwords or other credentials".

Maybe the biggest privacy risk is theft. A smartwatch may be harder to lose than your phone, by virtue of being strapped to your wrist, but should a strap break or you forget to pick up your watch as you leave your hotel room, it's vulnerable. Scott Lester, senior researcher at Context Information Security, reminds us that there is no "find my watch" feature for Apple users, "but there is at least a setting to wipe after ten failed passcode attempts". When it comes to Android Wear, users with devices that can connect to Wi-Fi do have the ability to remotely revoke them, although this still

won't wipe the data from the device.

APP ATTACK

Finally, what about the apps and any safeguards that are being built into app design to prevent attacks? Mark James, security specialist at Eset, is convinced that "apps will almost certainly be the biggest single failure we will see in this market".

According to MWR Labs, developers are often unaware of the changes that have been made to smartphones that allow them to communicate with their respective smartwatches. "Android Wear requires developers to create a service in their application, effectively creating an opening that is required to communicate data between Android and Android Wear," Jahmel Harris from MWR told us. "In theory, this service can only be used by Android Wear, but our research has shown it's possible to communicate with this service from a rooted wearable."

As a weakness in one may put the other at risk, it is particularly important that security controls such as root detection, obfuscation and integrity checking are performed on both the applications written for Android Wear and Android itself. "In the case of Apple Watch," Jahmel added, "MWR has seen developers weakening the security of the iOS application in order to allow sensitive information to be passed to the smartwatch."

Making sure these apps are clean and originate from known sources will be a big responsibility for watchmakers. As Mark James concludes: "Making sure the app design, submission and distribution is meticulously monitored is the only way to protect the users." ●

WHICH SMARTWATCHES WOULD THE EXPERTS TRUST?

Would our security experts trust one smartwatch platform over another? Here's what they told us:

Bharat Mistry from Trend Micro backs... Apple

"Physical device protection across all smartwatches is very poor. Our research found that none of the authentication via passwords or other means is enabled by default. This means that free access could be achieved if the wearable was stolen. All devices, apart from the Apple Watch, failed to contain a timeout function, meaning that passwords had to be activated by manually clicking a button and leaving the devices vulnerable if left unlocked. The Apple Watch is also the only smartwatch we tested that allows a wipe of the device after a set amount of login attempts."

Paul Le Messurier from Kroll Ontrack backs... none of them

"Regardless of the vendor or OS, smartwatches contain some serious security vulnerabilities, from insecure interfaces to insufficient user-authentication systems. However, while it is possible to hack a wearable device, there simply isn't enough data contained on smartwatches to make the challenge of hacking one worthwhile. For now, users should be more concerned about where their data is being shared and stored, as the real target for hackers is the manufacturer's cloud system to which your device is synced."

Chris Camejo from NTT Com Security backs... Apple

"Historically, Apple's approach to security on the iPhone has had quite a bit of success. The closed-platform, walled-garden App Store, rapid closing of jailbreaks and other security vulnerabilities, and overall software design have combined to make iPhones fairly resistant to attacks. The Android platform, on the other hand, is very fragmented and harder to patch consistently. The result is that most mobile malware affects Android but not Apple's iOS. It wouldn't be too far-fetched to expect that the trend will continue, with the Apple Watch being a more secure but more limiting platform, while Android is wide open but exposes more vulnerabilities."

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XBOX ONE

THE MUST-HAVE PC COMPANION

BARRY COLLINS EXPLAINS WHY THE XBOX ONE CONSOLE
IS THE PERFECT PARTNER FOR YOUR WINDOWS PC
– EVEN IF YOU DON'T PLAY GAMES



Microsoft has refocused its media centre ambitions on the Xbox One

When Microsoft announced that its venerable Media Center application wasn't going to make the cut in Windows 10, many PC & Tech Authority readers doubtless let out a mournful sigh. The era of the front-room entertainment PC seemed to be over.

But Microsoft had its eye on the bigger picture. The Xbox One might be regarded merely as a games console, but its all-round entertainment capabilities make it a better fit for the front room than the full-fat Windows PC ever was. The \$399 block of glossy black plastic is growing into a DVR, a media centre, a web browser, and a host for the same Windows Store apps you might run on PCs and tablets – and, of course, remains a fine games console. In fact, with Windows 10's ability to stream games from the Xbox to the screen of a laptop or tablet, it arguably circumvents the need to run games on your PC at all.

In short, the Xbox One is fast becoming a must-have companion device for the PC. Far from displacing the original vision of the Windows Media Center, it builds on it – just not in the shape of a conventional PC.

In this feature, we'll explain the new features of Microsoft's console that make it the ideal partner to your desktop PC, and explore what it all means for the PC itself.

A BETTER MEDIA CENTRE

Microsoft's Media Center application was a curious anomaly. Adored by its users, and critically well received, it never managed to grow beyond cult status – even when noughties PC makers created some delectable little media PCs to pop under the television. That said, we can point to many possible reasons for Media Center's failure to go mainstream, most notably the advent of heavily subsidised set-top boxes from the likes of Sky and Virgin Media.

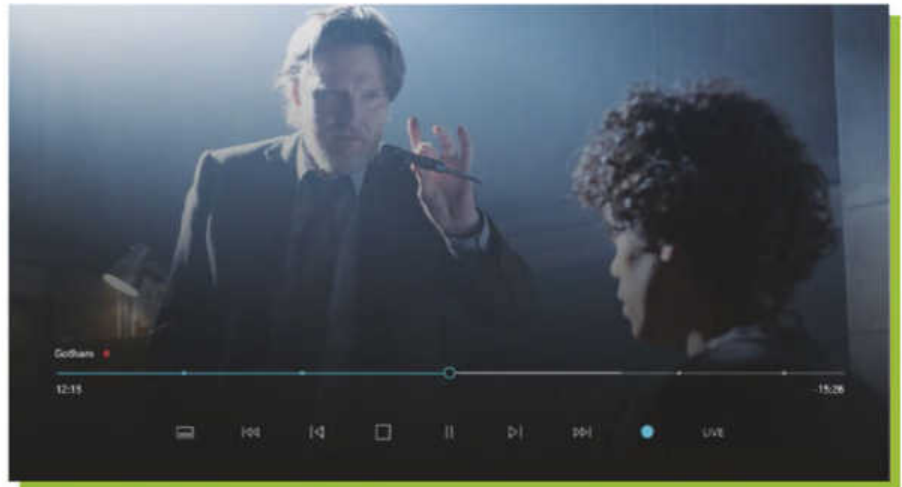
So it wasn't a huge shock when Microsoft began to phase out Media Center in Windows 8, making it a paid-for extra rather than an integral part of the operating system, as it had been in Windows 7. When the final list of features for Windows 10 was announced in January, few were surprised that Media Center had been quietly phased out. Some pundits have even suggested that the entire concept has had its day: "Media Center's biggest value was the combination of the channel guide, DVR functionality, and the user interface," said Wes Miller, an analyst for Directions on Microsoft. "Today the content is coming in from everywhere, and there's an app on everything to play it. The death of Media Center, in many ways, was because of the sun setting on the television as the family's entertainment hub."

Yet Microsoft hasn't given up on its media centre ambitions – it's simply refocused them from the Windows PC to the Xbox One. The console will accept an HDMI input from a set-top box, and can support a USB TV tuner – so whether you prefer satellite, cable or Freeview, it will integrate cleanly with your set-top boxes, allowing you to watch shows



“When the final list of features for Windows 10 was announced in January, few were surprised that Media Center had been phased out”

✓ An updated app network and DVR feature make Xbox One the next Media Center



✓ You can download recorded TV shows to your tablet or laptop – to watch them later on the train

✗ The Xbox has its own electronic programme guide, allowing you to scan schedules from within the console

from within the Xbox One's TV app. You can also connect an IR transmitter to allow the Xbox One to control your set-top box; if you have a Kinect sensor, you can change television channels either using voice commands (although this is patchy, to say the least) or the Xbox controller. The Xbox even has its own electronic programme guide (EPG), allowing you to scan the schedules from the console.

Meanwhile, the Xbox SmartGlass app allows you to view the EPG on the screen of a Windows tablet, and use the device as a glorified remote control. You can even stream the TV signal itself from the Xbox to the SmartGlass app, effectively turning your tablet into a portable television.

Perhaps the best reason to connect your TV to your console is the option to snap the television picture to the side of the screen whilst you're using an Xbox app or game. This lets you keep an eye on the football, while enjoying your own game of FIFA, with the option to easily flick into full-screen if

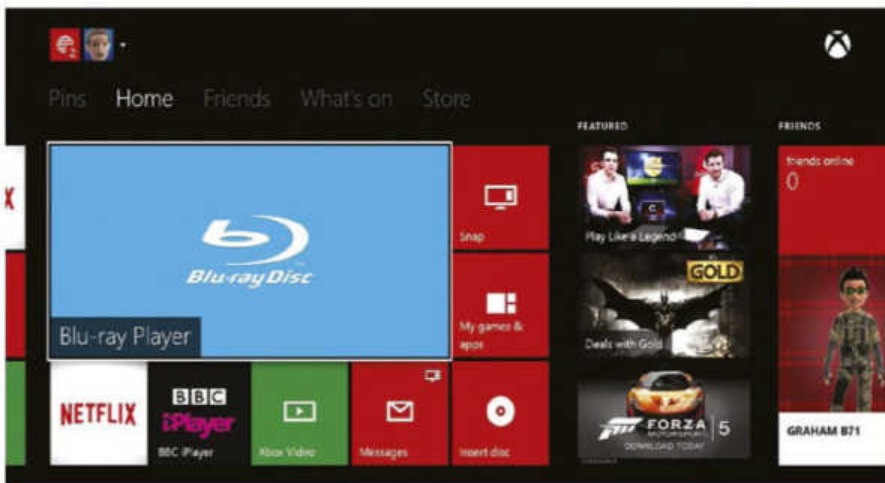
you can see a goal coming.

The one thing that's missing is DVR capabilities: despite the Xbox One's hundreds of gigabytes of available storage, there's no way to record television shows on your console. That's set to change with a major update rolling out which officially upgrades the Xbox One to Windows 10. As well as an updated app framework (see below), this will bring a new DVR feature that turns the Xbox into a true successor to Media Center, with features that Sky+ and TiVo set-top boxes can't match. As well as scheduling recordings from the Xbox EPG when you're sat in front of the television, you'll be able to set recordings remotely using the Xbox SmartGlass app on your smartphone. You'll also be able to stream recorded shows from the Xbox to your mobile or Windows 10 devices. You can even download the recorded shows to a tablet or laptop, so you can watch on a plane or on the train to work.

However, there are a couple of catches. First, you'll need to plug in an external hard disk: even though the latest-generation Xbox One hardware comes with a terabyte hard disk, you're not allowed to store recordings on the internal drive, ostensibly to avoid interfering with the games stored on it. Second, while you can happily record Freeview shows, the DVR facility won't work with satellite or cable set-top box feeds. Nevertheless, the Xbox One could well tempt viewers to make it their primary recorder.

WINDOWS 10, APPS AND CORTANA

The Xbox One has long had its own library of native apps, as did the Xbox 360 before it. Predictably, most of them focus on video and entertainment. At the time of writing, the 100-strong library of downloads includes Netflix, TuneIn Radio, YouTube and various apps for recording and sharing games footage. That means the Xbox One is already competitive with most other streaming



THREE THINGS YOU'LL NEED TO MAKE YOUR PC AND XBOX WORK IN HARMONY

A DECENT DUAL-BAND ROUTER

Streaming Full HD games and videos across your home network requires plenty of bandwidth. If you can't run a wired Ethernet connection between your PC and console, you'll need a decent wireless connection. In our experience, an 802.11ac router is your best bet for reliable, stutter-free games streaming. If you're still on 802.11n, that doesn't have to ruin your fun as long as your network isn't too prone to congestion and interference: switching to the 5GHz band, rather than the default 2.4GHz band, can help.



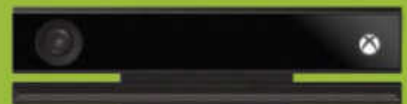
THE XBOX ONE SMARTGLASS APP

Now available on iOS and Android, and for Windows mobiles and tablets, SmartGlass acts as a fancy remote control for your Xbox One. If you run your television through the console, the SmartGlass app hosts the electronic programme guide ("OneGuide"), allowing you to switch channels without having to reach for an Xbox controller or rely on the finicky voice controls. A forthcoming update will add the facility to remotely schedule television recordings from your smartphone.



KINECT

Microsoft originally made the Kinect a mandatory part of every Xbox One bundle. It's since dropped that requirement, but if you want to use your Xbox One as a DVR it's a wise investment. The Kinect includes IR emitters that can be used to change the TV channels on your set-top box. If you don't have a Kinect, you can buy emitters separately, but that can create an ugly tangle of wires under your television. Kinect voice commands also make it easier to perform basic functions on the Xbox One, such as snapping the picture to the side of the screen.



devices, such as the Apple TV, Roku and Amazon TV.

With the Windows 10 update expected in November, that app selection could – and we emphasise “could” – be massively expanded. This will allow the Xbox One to run Universal apps from the regular Windows Store, just as on a PC, phone or tablet. Microsoft has publicly spoken of “thousands” of apps becoming available to Xbox One owners, with those already purchased on other platforms being eligible for free download.

Obviously, an app designed for a tablet interface may not translate perfectly to a console. Most Windows Store apps are designed for a touch interface, so they may be difficult to control, even with a Kinect sensor. Console users also sit some distance from the screen, while phone and tablet users have it pressed in front of their faces: text, graphics and icons will likely need to be resized to suit a 42in TV rather than a 10in tablet.

This means app developers will need to approach their Windows apps like modern websites, with responsive designs adjusting the user interface to suit the size and capabilities of the screen – and the Xbox store will only house those apps suited to run on the console. Head of the Xbox division, Phil Spencer, told developers: “We won't see people using Excel on the Xbox, but Microsoft is making it easier to port experiences from PC over to Xbox where they make sense.”

So what types of app are likely to appear for the Xbox One? You could easily imagine services such as Spotify, eBay, weather apps, travel agents and fitness tracker Fitbit embracing the Xbox One – Microsoft will be

“You'll be able to stream shows from the Xbox to your Windows 10 devices”

throwing money at some big names when the console transitions to Windows 10.

Another Windows 10 import is Cortana. Those with a Kinect sensor may already be used to issuing voice commands to their Xbox, but the update will see Cortana make its debut on the console. It will take on many of the duties already assigned to voice controls, such as challenging friends on Xbox Live. Cortana will also work across devices. So, if you set a reminder on your Windows Phone or desktop PC to call your brother at 8pm, it will interrupt the movie you're watching on the Xbox to remind you.

STREAMING FORWARD

Gaming is the Xbox One's raison d'être. When Microsoft unveiled Windows 10 back in January, it wasn't the blue-sky hoopla surrounding the HoloLens that got many people excited, but the ability to stream games from the Xbox One to Windows 10 devices.

The feature was switched on in one of the final Insider builds of Windows 10 before the desktop OS launched at the end of July. Instead of being tied to the living-room television, gamers can now wirelessly beam their games to a PC in a bedroom, or even a tablet. The receiving hardware doesn't need to be powerful, as it's essentially just receiving a video feed – all the processing is done on the Xbox.

Plug an Xbox One controller into a USB port on the receiving PC and you can play as if you were sat in front of the television. At first, streams were restricted to 720p, but an update has boosted the maximum stream quality to 1080p at 60fps. As long as your wireless router has sufficient bandwidth (see right), and your receiving device has a high-res screen, you can play remotely in Full HD, with no compromise to graphics quality.

It's a capability that raises questions about the future of video games. Gaming on Windows has been in decline for years: you'll struggle to even find PC games in many high-street retailers these days. Xbox streaming potentially turns even lowly \$200 tablets into 3D-gaming machines, and while there's still a market for those who want to play Crysis at punishingly high frame rates on 4K screens, most gamers will settle for the Full HD output from an Xbox, especially if it means not having to upgrade their graphics card every couple of years.

There's another difference between PC and console gaming: the controls. Many still prefer a keyboard and mouse to a handheld controller, and the Xbox One will offer support for these in games. Once the console moves to Windows 10, there may be no discernible difference between playing a game on the Xbox One and on a regular PC. Xbox owners can already play online against PCs, and parity of controllers could see even more titles span both console and PC.

The distinction between the Xbox and a PC is becoming very blurred. Soon, the only difference between the two will be the user interfaces. The Xbox One hasn't just become a must-have companion for your PC: it's become a PC in its own right. ●

IN THE LABS

All of the tech

Mega machines

BEN MANSILL GAZES AT THE LAB SLAB...

It shouldn't come as too much of a surprise that Microsoft has aimed for the high end with its new Surface Book. For a company that has been a huge part of tech for so long, to have its first PC launched just this year is a remarkable moment. Yes, the Surface (non-Book) is also technically a PC, but I don't think it's inaccurate to describe the Surface Book as the first 'true' Microsoft laptop.

So, with pride at stake, and fuelled by the optimism and drive towards innovation that the Nadella era seems to be characterised by, we see in the Surface a truly exceptional piece of engineering and design. It's almost impossible to find compromise – everything from the magical 'muscle wire' mechanism that locks the screen into place, to the ability to detach the screen while continuing to work on certain apps is state of the art.

And just as the company does with the Surface product line (the tablet + Touch

keyboard one, not the Book), you have a fairly generous range of specifications to mix and match. The Book can cost \$2,299 with an i5, 128GB SSD and 8GB of RAM, or it can cost \$4,199 with an i7, 512GB SSD and 16GB of RAM. And in between those extremes you have an additional pair of spec choices.

I like that. It's common, of course, to be able to spec-up (or down!) a machine, companies like Dell and HP usually allow customisation to a pretty significant degree. You still get the same engineering and materials, and the cool cache in the boardroom or cafe, and you still get something you personally may lust for but can't quite stretch to the full turbo V8 model.

By all accounts the Surface Book is a big sales smash hit and Microsoft can't get enough of them into the country quick enough. Mr Agius has reviewed the Surface Book for PC & Tech Authority this issue, that story unfolds on page 34.

AMD, AGAIN...

AMD needs a break, that's for sure. So it pains us a little to have to review the Sapphire R9 380X so poorly this issue. As Bennett spells out so unmistakably in his review starting on page 46, it's a decent product that's been rendered... unappealing by the sad state of the Australian dollar. And not just the state of the dollar as we go to print, but that it was a lot stronger back when many resellers bought stock of the competing Nvidia GTX 970.

MEGABOARDS

So we have another \$800 motherboard. Amazing but true. Along with the Gigabyte Z170 Gaming G1, the new Asus Maximus VIII Extreme is an ultra premium product, and in this case, the dream motherboard for overclockers. Frankly, I'm amazed it's taken this long to get there, these are majestic pieces of engineering.



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WHAT OUR A-LIST MEANS

Our A-List award is reserved for the best products in each category we review. With a winner and an alternative pick in each, that's 92 products you know are first class.

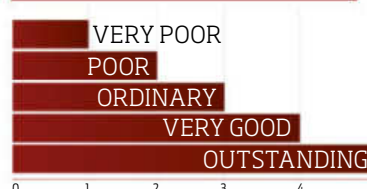


WHAT OUR AWARDS MEAN

PC & Tech Authority's comprehensive Real World testing sorts out the best products from the pack. Any product recommended by PC & Tech Authority is well above average for features, value for money and performance.



WHAT OUR RATINGS MEAN



HOW WE TEST

Our benchmarking tests are the best in the business. Read on to find how they work...

2D TESTS

Desktop PCs and laptops are tested using our own custom bench testing suite, which has been carefully designed to test all aspects of a system and rate them in a way that's useful to you.

Our benchmarking cover three main tests: a typical video editing test, a demanding 4K video editing test and a multitasking test that stresses all aspects of the system.

We look at the time it takes for each test to run, which is then compared to our reference PC to produce a normalised result. This score is shown on a graph, and to help you understand just where the PC we're reviewing sits in the grand scheme of things, we will often include other system's scores.

The median score of 100 is based on our reference system:

PC & TA REFERENCE PC. SCORE: 100

Intel Core i5-4670K CPU; 8GB of DDR3 RAM;
AMD Radeon R7 260X graphics card

On occasion we will run publically available bench testing software, predominantly PCMark 8 from Futuremark. This is run in the Home setting, in Accelerated mode. You can get PCMark 8 as well as 3DMark (below) from www.futuremark.com

3D TESTS

For video cards, as well as Integrated Graphics Processing Units, we use:

- 3DMark Firestrike
- Shadow of Mordor
- GRID Autosport

3DMark is designed specifically to test video cards, and you can download and run the same tool as us to help you gauge where your own GPU ranks compared to what we are reviewing.

The two games were selected because they are relatively well balanced in performance between AMD and Nvidia, favouring neither. Both feature a wide range of DirectX 11 shaders. GRID Autosport is fairly easy on GPUs, while Shadow of Mordor is quite demanding, so each provides a helpful gauge for you showing what to expect from a GPU in your favourite games. We will update these to cover DX12 once that API gains traction.

Tests are run using three resolution ranges, depending on where the GPU sits in the market:

Entry level: 1920 x 1080

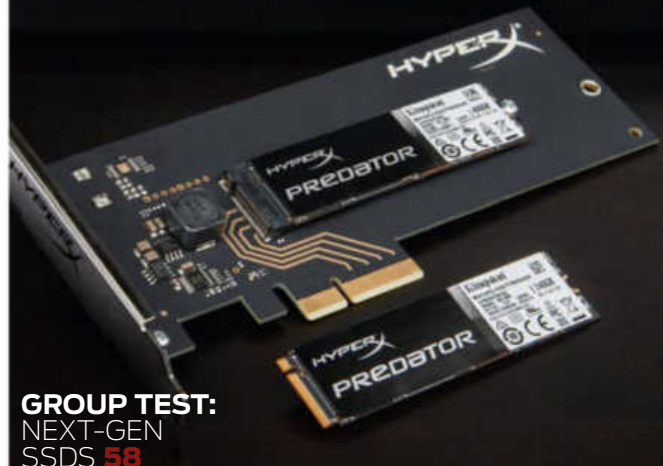
Mid-range: 1920 x 1080 – 2560 x 1440

High-end: 2560 x 4K

BATTERY TESTS

Screen brightness is set to 120cd/m2, playing a 720p video on loop until the device runs out of power.

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Apple iPad Pro

APPLE'S NEW FLAGSHIP, WITH ITS EXCELLENT SMART KEYBOARD AND APPLE PENCIL, IS AN EYE-POPPINGLY GOOD TABLET AND A CAPABLE LAPTOP

This year, for the first time since 2010, Apple didn't update its flagship iPad. Except it did. Suddenly, the iPad Air 2 isn't Apple's classiest tablet any more. It's been overtaken by a more advanced, bigger brother.

The iPad Pro has just gone on sale, and I've been putting it through its paces for more than a week to see if it lives up to the hype – and price tag.

DESIGN

One glance tells you this is an iPad, thanks to its glass front, aluminium rear, chamfered-edges and all-over immaculate build quality. It has an identical design to the iPad Air 2 and iPad mini 4. The front is all display, surrounded by narrow bezels on the longer sides and wider ones at top and bottom. A camera lens peeps out from the centre at the top and the home button with Touch ID capabilities nestles at the bottom.

Almost every other detail is the same as on the smaller-screened Apple tablets. Power button on the top edge: check. Volume buttons on the right edge: check. Whacking great Apple logo on the middle of the back: check. On the Wi-Fi and cellular model, plastic stripe on the back and SIM card slot on the right edge: check and check. Single loudspeaker on bottom edge: hold on.

The iPad Pro, uniquely in Apple's iPad range, has four speakers: two on the

top and two on the bottom edge. As you'd imagine, this design change really upgrades the tablet's audio capabilities.

There's another difference: on the left edge, three small circles sit innocuously in the middle. These form the Smart Connector, which attaches to the Smart Keyboard or third-party accessories such as the Logitech Create keyboard case.

For all the similarities, the Pro has one major difference to previous iPads: its size. The 12.9in display may not sound much bigger than the previous iPad's 9.7in screen, but it looks huge in comparison.

It's much heavier than the iPad Air 2, but still lighter than the first iPad, weighing 713g for the Wi-Fi-only edition, and 723g for the Wi-Fi and 4G model. It's heavier than many rival tablets, but still feels light for its size.

DISPLAY

The 12.9in, 2,732 x 2,048 display has the same pixel density (264ppi) as the iPad Air 2. It's a Retina display so it's pin-sharp and, as with most Apple displays, bright and colourful.

As always, this is an IPS LCD screen, not AMOLED, so colours aren't overblown or oversaturated, and it has the same anti-reflective coating as the iPad Air 2, making it readable even in bright light.

What really stands out is the size of the screen. It's as wide as the iPad Air 2 is tall, meaning there's a lot more space on offer. When you're working on a video-editing

app, this gives you a good-sized video window, along with the editing timeline below. If you choose the multitasking Split Screen view, where you can have two simultaneously active windows side by side, both windows are substantial and usable.

If you're using the iPad Pro to consume rather than produce content, it's a joy. Video playback is smooth and really shines on this display. Plus, the four speakers add a beefy sound that's better than any previous iPad's. The tablet reaches high volumes and the stereo effect is clearly discernible.

Intriguingly, when you turn the tablet from landscape to portrait, the iPad switches the orientation of the speakers so the left channel continues to come from the two speakers on your left.

SMART KEYBOARD

The Smart Keyboard is one of two essential peripherals for the iPad Pro. Just as the Type Cover hugely improves Microsoft Surface tablets, the dedicated keyboard turns the iPad Pro into a successful laptop substitute. Tim Cook recently said that, although he still loves his Mac, when he travels he takes the iPad Pro as his computer.

In some ways this keyboard is better than Microsoft's Surface keyboard because the keys (which, at first glance, look like they may not be up to much) are superb to use: firm but responsive and comfortable, even when used for long periods.

The base is solid enough for you to have it on your lap, too, but the big problem is that it can only prop up the iPad Pro at one angle. You may find this fits with your way of working, but there will almost certainly be a situation in which the tablet doesn't quite work perfectly.

Another issue is that, for now, only the US keyboard layout is available. Other layouts will soon follow and Logitech's cover is already available. It's a little cheaper than the Apple model at \$229 and even has backlit keys, but isn't as classily made. Still, it also covers the back of the iPad Pro, meaning it's better at protecting your hardware.

APPLE PENCIL

The Pencil is Apple's answer to the stylus. It's slim, perfectly weighted and a quintessential Apple beauty: sleek, elegant and highly effective.

If you've ever used a stylus with an iPad, forget everything you know: the Pencil is nothing like that experience. While using a stylus is a bit laggy and imprecise, the Pencil is fast, responsive and clean. Latency is, according to Apple, under 20ms – which means you don't notice it

at all in the real world.

Unlike most capacitive styluses, it has a slender nib, which is firm rather than squashy to the touch. That's because the tip of the Pencil, like some styluses from Wacom and N-trig, includes sensors that recognise pressure. Apple hasn't revealed how many pressure levels the Pencil can spot, but it certainly has a satisfyingly realistic feel to it. More than any other stylus I've used, it feels like using a real pencil on paper, with just the right amount of slide and friction. Tilt the Pencil on its side and you can even add shading as you draw.

Several things about the Pencil show off Apple's attention to detail. The cap, which covers the Lightning plug used to charge it, has a small metal ring and snaps to the top in a really satisfying way.

Apple has also thought through the practicalities. The top slides off to reveal an extended Lightning connector. This is used to pair the two and charge the Pencil – and it doesn't need long to deliver a useful amount of charge. In fact, Apple says that 15 seconds of charging will give 30 minutes of use.

I can't vouch for the accuracy of that, but it certainly seemed to have plenty of pep after the briefest of charges. And when it does run out of juice, it's reassuring to be able to revitalise it in less time than it takes to make a cup of tea.

One negative point here is that there's no sleeve or cavity in the iPad Pro or the Smart Keyboard to store the Pencil, so be careful you don't lose it. Moreover, at \$269, it's far from cheap, but if you want to make the most of the Pro, it's definitely a purchase worth considering.

Plenty of apps have already been optimised for the iPad Pro's bigger screen and

delicate Pencil. Apple's own Notes app is a joy to sketch on, especially with the virtual ruler, which offers spectacular precision.

However, the Pencil isn't perfect. One of the characteristics of the way a real pencil works is its interaction

with the material, and, in particular, the way the pencil drags when pushed or pulled across the surface. There's currently no real way that Apple can change this, as the screen

has to be flat and smooth, but it remains the best approximation of a pencil on paper that anyone has yet come up with.

PERFORMANCE AND BATTERY LIFE

Apple has included its most powerful processor yet in the iPad Pro. The A9 chip found in the latest iPhones has been beefed up with an X, and the iPad Pro also has extra RAM.

Whatever the specs, this is a tablet that feels consistently nippy and responsive. Even when editing video at 4K resolution, the iPad Pro didn't slow down. Tasks from video playback to side-by-side email and web surfing were swift and easy to accomplish.

Apple has said that it's faster than many portable PCs, including a few MacBooks, and the benchmarks seem to confirm this. For example, a high Geekbench 3.1 single-core result of 3,192 and a multi-core result of 5,413 are both significant improvements over the iPad Air 2.

I also ran the GFXBench Manhattan tests, which delivered results of 33fps for the onscreen test and 79fps for the offscreen test, run at 1080p. Again, these are seriously impressive results: faster than any Android or iOS tablet we've ever tested, and faster even than a mid-2014 MacBook Pro 13 equipped with Intel's integrated Iris Graphics 6100.

That said, one of Apple's guiding principles has always been to avoid statistics and instead focus on delivering a flawless user experience.

The other important indicator of performance is battery life, and that's an area in which Apple's iPads have always been consistently good. There's a large, rich screen to service here and one heckuva big battery to power

it – a 38.5Wh battery, to be precise. And in our video-rundown tests, the iPad Pro performed admirably, lasting a solid 9hrs 8mins (in flight mode, with the screen set to a brightness of 170cd/m²) before expiring.

VERDICT

The iPad Pro is a stunning machine. It looks fantastic and, once you get over just how big it is, the size becomes a benefit, with its immersive screen and giant playground of real estate for apps to exploit.

Add Apple's Smart Keyboard or a rival setup and you have a great laptop alternative, with a decent battery life and an unparalleled choice of many big-screen, touch-enabled apps. The Pencil adds a whole new dimension of usability and is an enjoyable peripheral to use.

It's expensive, though: add it all up and you're spending more than \$2134 for the full set of tablet, Pencil and Smart Keyboard, and you can pay even more to boost storage from the stock 32GB to 128GB. But, despite this, the iPad Pro is not bad value at all. For your money, you're getting a fast, capable laptop running on iOS, and an eye-poppingly good tablet with ear-tingling audio to boot.

The iPad Pro marks another major inflection point: it ends the whole "iPads are only for consumption" debate. The only people who can't use the iPad Pro as a creation tool are those who need really high-end performance: professional graphic designers and video editors – the kind of people for whom 16GB of RAM is table stakes.

Most people don't fall into that category, and the iPad Pro is more than sufficient as a creation tool. For some users – anyone who sketches or loves using a stylus – it's a better creative tool than your average PC or laptop. There are other smaller, lighter and much cheaper iPads. But, if the large size appeals, the new Apple flagship is hard not to like.

David Phelan

BATTERY LIFE

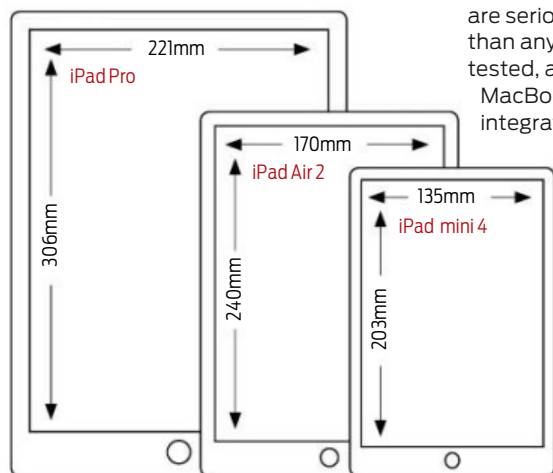


KEY SPECS

\$1249 • www.apple.com/au

Apple A9X processor • M9 motion coprocessor • 32/128GB storage • 12.9in 2,732 x 2,048 IPS display • 802.11ac Wi-Fi 14G (optional) • 38.5Wh battery • iOS 9 • 1yr RTB warranty • 221 x 7 x 306mm (WDH) • 713

OVERALL





Microsoft Surface Book

MICROSOFT'S PREMIUM 2-IN-1 SURFACE SURPASSES ALMOST EVERY OTHER NOTEBOOK ON THE MARKET TODAY

For decades, Microsoft left making computers to their OEMs like Dell, HP, Lenovo and countless others. It would be surprising if behind the scenes, Microsoft didn't drop hints, or take an active role in the development of the OEMs hardware. Regardless, Microsoft's relationship with the OEMs was clear - we make the software, you make the hardware. That was the status quo until Microsoft unveiled the original Surface and now, Microsoft has pushed that already strained relationship even further with the Surface Book, a high end, premium laptop that can also be a tablet. A clear encroachment on the area once exclusively the domain of Microsoft's OEM partners.

Placing any OEM frustration at their biggest partner becoming a competitor aside, the Surface Book packs a 13.5-inch, 3:2 aspect ratio display, with a 3000x2000 resolution IPS panel, featuring full multi-touch capability and support for Microsoft's Surface Pen.

CPU wise the Surface Book uses the latest 6th generation Intel Skylake processors, with the choice of either the i5-6300U or i7-6600U. All the configurations have 8GB of RAM on-

board, except the top of the line model with 16GB. There's also the option of a discrete Nvidia GPU, if you need a little extra graphics grunt.

The Surface Book has all the usual goodies you'd expect such as full sized SD card slot, 802.11ac Wi-Fi, Bluetooth 4.0, two USB 3.0 ports and a Mini DisplayPort output. The Surface Book's tablet weighs 726 grams and combined with the base it's 1.51kg. The Surface Book is available in four different configurations, ranging from the base model at \$2,299 up to an eye watering \$4,199 for the top of the line unit.

Unboxing the Surface Book, you can tell this is a premium device. I've reviewed many laptops and tablets over the years and besides products from Apple, I've never handled a computer so cleanly designed as the Surface Book. The magnesium alloy body feels much nicer than an Apple aluminium laptop, leaving much less finger prints. There's no obnoxious stickers, no large random vents - there aren't even any visible screws, a major contrast from the laptops Windows typically ships on. Microsoft's industrial designers deserve major kudos for creating such a sharp and timeless design. The power adaptor even has a 5W

USB port on it - one less thing to pack.

The most obvious design effort on the Surface Book is the "Dynamic Fulcrum Hinge" (Microsoft's words, not mine), that manages to keep the screen/tablet attached to the keyboard base without tipping over. Quite a feat considering the screen weighs more than the base, something not the case with most laptops. The unique hinge extends when folded open, increasing leverage to the base. This removes the need for a kickstand to prop the display up like on the Surface Pro or HP's Spectre X2. Unfortunately, this does result in the inability to close flush, leaving a gap near the hinge where normally the laptop's screen would rest upon the keys. It also reduced the angle the screen can open up to, a slight inconvenience for tall people using the laptop on a low table.

Unlike most 2-in-1 tablet/laptops, the Surface Book's base isn't a fabric or thin style keyboard and a sub-par trackpad. It's a proper laptop keyboard, with full sized, backlit keys with a great key travel and a large trackpad, which also supports multi-touch gestures. The base of the Surface Book is simply a large battery and USB hub with a keyboard and trackpad

> The innovative hinge gives the Surface Book a uniquely individual look



attached. The discrete GPU also lives in the base on the higher end configs. The tablet (or Clipboard as Microsoft likes to call it) is attached extremely securely to the base via shape memory nickel-titanium that requires electricity pass through it in order to detach. The result of this nifty science is that the screen has a rock solid attachment to the base. It also means that the hinge doesn't move when the screen isn't attached, preventing it from snapping accidentally. To release the screen, there's a button the keyboard you push down on, that activates a current along the hinge and a loud clunk releases the screen from the base.

Thanks to the Surface Book's two batteries (one in the base, one in the tablet) it can operate away from a power outlet for a long, long time. In the standard PC & Tech Authority battery test, I set the screen to a brightness of approximately 125cd/m2 and let a 720p H.264 video play in a loop. It kept going for 13 hours and 57 minutes. With a total 70 Wh of battery capacity, it's not surprising the Surface Book can last so long. From my own anecdotal use, I've been able to get around 10-11 hours of battery life whilst doing my usual relatively light workload of web browsing and writing. By far the longest I've been able to work unplugged and particularly impressive for a laptop with such a high resolution display, which generally results in lower battery life.

The tablet portion however, only achieves 3.5-4hrs of battery life. The same CPU in the Surface Pro 4 for example, manages 7-8 hours of battery life. This is because the battery inside the Surface Book is half the size of the battery inside the Surface Pro 4. Having a full sized battery in the Surface Book's tablet, in addition to the base having its own battery (necessary to make the base weighted enough so the screen doesn't topple over) would mean the entire kit would be far too heavy.

Performance wise, the Surface Book is as good, if not better than most laptops or 2-in-1 devices. The i5-6300U and i7-6600U processors are the latest Skylake

6th generation chips from Intel and will handle practically anything you can throw at it. Due to the low thermal envelope that comes with such a slim design and the fact the Surface Book is also a tablet, don't expect a quad core, virtualisation, video encoding monster. The option for a discrete GPU in the Surface Book's slim body is another thing laptops in this class simply don't offer. The GPU is a custom part from Nvidia, with performance very similar to the GT 940M. Whilst it isn't the most powerful GPU available, if you're using it for some casual gaming or for a performance boost in CUDA aware applications it'll work a treat.

As a laptop, the Surface Book is excellent, but how is it as a tablet? The

“There's no doubt that the Surface Book is by far the best 2-in-1 laptop/tablet out there”

13.5-inch screen has a 3:2 aspect ratio, a much more suitable form factor for a tablet than some of the other 2-in-1 devices sporting a 16:10 or worse, 16:9 display. Using the tablet on its own is extremely fast, as unlike other tablets which have relatively cut down processors and slow eMMC storage, the Surface Book is a full i5 or i7 CPU, with a blazing fast PCIe SSD. It blows all the other tablets out of the water when it comes to performance.

Included with the Surface Book is the Surface Pen - an active Bluetooth stylus designed for the Surface range. Much has been written about the Surface Pen when used on the Surface Pro 4 and it's no different here, with the Surface Book packing the same stylus and the having same levels of pressure sensitivity and fast cursor tracking speed. Perfect for drawing diagrams or note taking in



OneNote or even full on sketching or artistic work in Adobe's Cloud range of programs.

The best product to compare the Surface Book to is Microsoft's own Surface Pro 4. The guts are the same, with the main difference being the inclusion of a proper keyboard and trackpad, and in the higher end models, a discrete GPU. The i5 CPU, 256GB SSD and 8GB of RAM Surface Pro 4 with a Type Cover is \$2,198.95. The Surface Book with the same i5 CPU, 128GB SSD and 8GB of RAM is \$2,299. The Surface Pro 4 weighs only 1078 grams with the Type Cover, versus 1.51kg for the Surface Book. However, the Surface Book will get around 10-11 hours of battery life compared to the Surface Pro 4's 7-8 hours. But as a tablet, the Surface Book only has 3-4 hours of battery whereas the Surface Pro 4 will achieve the same 7-8 hours as a tablet or as a laptop with the Type Cover. If you're using the Surface predominantly as a laptop, using the keyboard and trackpad often, or require a higher end model with the discrete GPU, get the Surface Book. Otherwise, enjoy Microsoft's lighter and slightly cheaper Surface Pro 4.

There's no doubt that the Surface Book is by far the best 2-in-1 laptop/tablet out there. It has the best fit and finish of any laptop I've ever used and the tablet on its own would be class leading. If you can justify the cost of the Surface Book, you'd have to be the pickiest of consumers not to be satisfied with it. Just don't think about the cost and you'll love it.

Anthony Agius

KEY SPECS

\$2,299 - \$4,199 depending on configuration

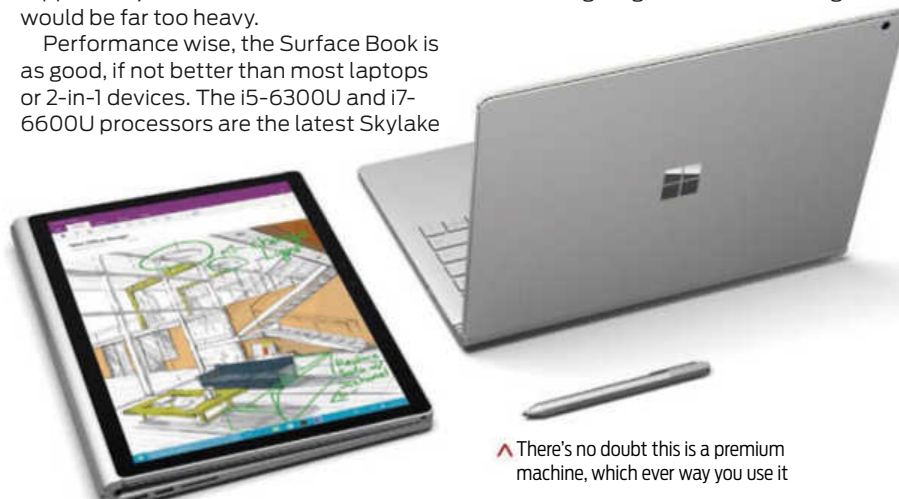
• www.microsoft.com.au

13.5-inch 3000x2000 IPS display • Intel i5-6300U/i7-6600U CPU • 8/16GB RAM, optional Nvidia GPU • 256/512GB PCIe SSD • 802.11ac Wi-Fi • Bluetooth 4.0, 2x USB 3.0 • Mini DisplayPort • Windows Hello front camera • Surface Pen • 1.515kg laptop • 726g tablet.

OVERALL



▲ There's no doubt this is a premium machine, which ever way you use it



MSI GE72 2QD Apache Pro

BIG, BRASH AND POWERFUL - A MONSTER OF A GAMING LAPTOP AT A VERY REASONABLE PRICE GIVEN THE SPECIFICATION

MSI doesn't do middle-of-the-road laptops – it makes brash, in-your-face laptops built for gaming. With the GE72 2QD Apache Pro, it delivers a 17in beast packed with powerful components at a modest price.

It's not ugly, despite its size. The base may be plastic, but the lid and keyboard surround are clad in brushed black aluminium. I can't fathom why MSI thought it wise to extend the brushed-aluminium look to the touchpad, though. In reality, it's still plastic, but lacks the smooth glide of normal touchpads. However, the fact that most keen gamers will opt for a dedicated mouse mitigates this decision.

Once you switch it on, the Apache Pro has a hallucinogenic haze of ever-changing lights that beam out from beneath the keyboard. You can switch these off but – call me crazy – I rather liked them, especially the option to create a rainbow selection.

As with most 17in gaming laptops, the GE72 is a desk hog. It measures 419 x 280 x 29mm (WDH) and weighs a hefty 2.7kg, so you aren't going to want to lug it around. Still, this is a do-it-all laptop designed to replace a hulking desktop, not a commuter's companion. It even has a DVD writer.

At the heart of it all is a fifth-generation Intel Core i7-5700HQ processor with a nominal clock speed of 2.7GHz, Turbo Boosting to 3.5GHz in times of need. Backing that up is a respectable 8GB of RAM (expandable to 16GB), plus an Nvidia GeForce GTX 960M supplied with 2GB of GDDR5 memory. When you don't need the power of the 960M, Intel's on-chip HD Graphics 5600 GPU takes over and eases the burden on the battery. As for storage, the Apache Pro is equipped with a 128GB SSD, plus a mechanical 1TB hard disk.

✓ You won't go short of ports on the Apache Pro



Windows 10 boots before you know it.

The Apache Pro aced the gaming benchmarks, too. Running through BioShock Infinite's benchmarking utility, the Apache Pro hit 81fps at 720p in Ultra mode. Knock up the resolution to 1080p and the frame rate drops, but it's still playable.

While the added grunt of the Core i7-5700HQ helps MSI's laptop get ahead in the games department, the limitation of 8GB of RAM means it falls short of the Helix 2 in our general-use tests, recording

“This is a do-it-all laptop designed to replace a hulking desktop, not a commuter's companion. It even has a DVD writer”

an overall score of 90 compared to the Helix's 96.

Connectivity is great, especially when it comes to video. You can plug in two external monitors via the HDMI and DisplayPort outputs, and if you own two 4K monitors, you can output to both simultaneously – although don't expect smooth, full-resolution gaming if you do.

The Dynaudio-branded speakers pump out a substantial sound, but the chassis vibrates at higher volumes. Elsewhere, you have everything you'd expect from a

▲ This 17in laptop is stylishly dressed in brushed black aluminium

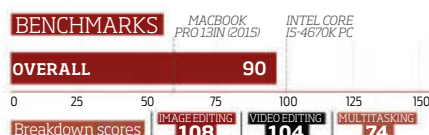
high-end laptop: three USB 3 ports, one USB 2, dual-band 802.11ac Wi-Fi, Gigabit Ethernet, Bluetooth 4 and an SD slot.

As you can imagine, with a 17in screen and an i7 processor, the Apache Pro devours the battery. It lasted 3hrs 6mins playing a 720p video with the screen set to a brightness of 170cd/m2, and you can expect half that figure when you play games.

The worst aspect of the Apache Pro, however, is its display. While it's not drastic enough to ruin games, it's not pleasing on the eye. Maximum brightness is decent at 281cd/m2, and a contrast ratio of 1,222:1 ensures that images pop off the screen, but colour accuracy is poor. MSI's IPS panel gives many colours a blue cast, although it does bundle an app that lets you tweak the display.

None of that will matter if you plug the laptop into an external display, of course, and as soon as you boot up Fallout 4 or run through the plains of Eorzea in Final Fantasy XIV, you'll stop caring about its shortcomings, knowing that you've got a great gaming laptop at a bargain price.

Vaughn Highfield



KEY SPECS

\$1899 • www.msi.com.au

Quad-core 2.7GHz (3.5GHz with Turbo Boost) Intel Core i7-5700HQ processor • 8GB RAM • 128GB SSD • 1TB hard disk • DVD writer • 17.3in 1,920 x 1,080 IPS display • Nvidia GeForce GTX 960M graphics • 802.11ac Wi-Fi • Bluetooth 4 • Windows 10 • 1yr RTB warranty • 419 x 280 x 29mm (WDH) • 2.7kg

OVERALL



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Dell XPS 13 9350

A VERY APPEALING ALL-ROUNDER

Dell's XPS range of laptops have always been some of the better looking laptops out there. With their slim profile, light weight, and solid construction, it's always been on my shortlist of premium Windows ultraportables with substance to match their style.

The new generation is no different. With its brushed aluminium exterior and its carbon fibre composite palm rest, it definitely feels like a high-quality product. The laptop's hinge feels bulletproof with zero creaking, and closing the laptop lid is reminiscent of the satisfying clunk of closing the door of a European car. Despite its solid construction, the XPS 13 is still a lightweight, tipping the scales at a mere 1.2kg.

The review model only had the 1080p display, not the QHD+ touchscreen (which is available on the higher-spec models). Even so, it's a hell of a display, and is definitely the centrepiece of the laptop. The screen itself is nice and bright, and has excellent viewing angles, in both the X and Y axis.

What makes it all the more impressive is the wafer thin bezel around the top and sides of the screen. It really does make the screen look much larger than its 13.3in dimensions. Watching movies on the display is a fantastic experience, with the picture almost suspended in mid-air.

Such a thin bezel does mean that

some compromises had to be made. The webcam's usual location in the middle of the top bezel is no longer an option, so it's been relocated to the lower left instead. This leads to a less than flattering upward angle of your face when you're using it, but it's a minor gripe. The picture quality from the webcam is still decent, despite its new location.

The backlit, chiclet-style keyboard feels great to the touch. The key travel is ever so slightly less than other laptops out there, but the keys are still nice and responsive, and touch typing is no problem on the laptop.

The multitouch trackpad is just as responsive as the keyboard, and the various gestures were registered without any discernible lag.

Port-wise, the left side contains the power socket, Thunderbolt 3 port (with USB-C compatibility), USB 3.0 port and a 3.5mm combo jack. On the right is a second USB 3.0 port and an SD/SDHC/SDXC multcard reader. You'll notice that there's no HDMI or VGA port. The expectation is that you'll purchase an adapter that uses the Thunderbolt port to provide that functionality (along with Ethernet, should you require that).

Audio is provided by twin speakers on either side of the chassis, and the sound quality is quite impressive for laptop speakers, especially ones as thin as those installed in this device, with

only a touch of distortion at the highest volume levels. Due to their installation on opposite sides, stereo separation is better than most models out there, but they're still no substitute for a decent pair of headphones.

Time to look at the guts of the laptop. At its heart is a Skylake i5-6200U CPU, running at 2.8GHz. 8GB of LPDDR3 RAM is also provided, and storage is handled by a 256GB SSD. This gives the laptop more than enough power for all but the most intensive media editing tasks.

Wireless is of the 802.11ac 2x2 variety, and Bluetooth 4.1 is also available. The laptop is definitely not the bottleneck when it comes to web browsing and downloading files.

There's no discrete graphics card, but this laptop was never designed to be a gaming powerhouse. Having said that, the Intel HD Graphics 520 is still a dab hand at playing some 3D games. Just don't expect to be hoarding items in Fallout 4 with maxed out display settings.

Windows 10 Home is the OS of choice here, and Dell have kept the bloatware to a minimum. They do provide a 12-month subscription to Adobe Photoshop Elements 14 and Premiere Elements 14, which is a nice addition, along with McAfee Live Safe (again, a 12-month subscription). Microsoft Office 2016 can also be purchased as an optional extra, if you wish.

Battery life is very impressive, and you'll be getting well over 11 hours of run time, assuming you're only surfing the web and working on the occasional document. Its endurance isn't quite on par with the MacBook Air, but the XPS 13 does have a higher resolution display to power.

There's a whole lot to like about this laptop, and criticisms are scarce. If you want a great combination of looks, power, portability and battery life, you'd be wise to give the XPS 13 plenty of consideration.

Peter Gutierrez



KEY SPECS

\$1999 • www.dell.com.au

13.3in 1920x1080 display • Intel Core i5-6200U 2.8GHz CPU, 8GB LPDDR3 1866MHz RAM, 256GB PCIe SSD • 802.11ac 2x2 Wi-Fi, Bluetooth 4.1

OVERALL



Samsung S34E790C 34" Curved Monitor

A HUGE 34", CURVED, 21:9, 3440X1440 MONITOR THAT DROPS THE BALL ON TEXT RENDERING QUALITY



Curved displays are Samsung's thing lately, so it's no surprise they'd take what's in your living room and pop it on your computer desk. The 34" ultra-wide S34E790C monitor is pretty much a small Samsung TV.

It sports a native resolution of 3440x1440, which is a not so common 21:9 aspect ratio - perfect for placing multiple windows side-by-side. It's also perfect for watching movies that are in the traditional cinema aspect ratio of 2.39:1, removing the black bars from the top and bottom.

Gamers will love the S34E790C as it practically acts as two and a half 1080p displays side-by-side - great for games that support AMD's Eyefinity or Nvidia's Vision Surround, without the need for multiple displays and monitor bezels getting in the way. Not all games will support the 3440x1440 resolution

however, so they'll need to run letterboxed.

Curving the display is a bit of a gimmick in my opinion. I've used a conventional flat 34" and compared to the curved S34E790C, there's not much difference. That said, the curve is much more appropriate on a computer desk, where your head is in the middle of the display, rather than in the living room where your viewing angle is unlikely to be ideal.

Unfortunately, despite hours of fiddling with settings and borrowing a calibration device to find out why text looked so weird, I couldn't get text looking as crisp as it should. Compared to my old Dell 27" IPS display and previous 34" monitors that have graced my desk, the image quality for general desktop use has left me disappointed. To my eyes, it appears as if there's a thin film of Scotch Magic Tape between the text and my eyes,

which results in very slightly blurred text that no matter how much I fiddle with the sharpness setting, won't look right.

This fact alone makes Samsung's S34E790C quite difficult to recommend versus the LG 34UC97, which is vastly superior for not much more cash. There's no redeeming features here that would make it a better buy than LG's 34UC97.

Anthony Agius

KEY SPECS

\$1499 • www.samsung.com.au

34" screen size • 21:9 aspect ratio • curved VA panel • 300cd/m² brightness • 3000:1 contrast • 4ms GTG response • 3440x1440 resolution • 178° viewing angle • 2x HDMI • 1x DP • 4x USB 3.0

OVERALL



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Asus Transformer Book 2-in-1 T100HA

A NEW BUDGET CHAMPION

According to PC market analyst IDC, the Windows 2-in-1 market is looking to experience a rather impressive 59.5% year on year growth in 2015, making it one of the most important segments to PC manufacturers. It's no wonder then that we're seeing a flurry of excellent new 2-in-1 products launching in the tail end of 2015, and last month we checked out the brilliant Toshiba Click 10. Aiming to undercut Toshiba's \$700 product is the new Asus Transformer T100HA, which shaves almost \$200 off the selling price. At just over \$500, this represents unprecedented value for a 2-in-1, and to our delight Asus hasn't had to cut many corners in the process.

To our amazement, Asus has used a fully metallic case on the T100HA, which lends it a ruggedness and sturdiness that plastic products like the Click just can't compete with. Yet it's still extremely light, weight a mere 580 grams without the base, and a total of 1.04kg with the base in place. We're guessing part of the reason for this is that the base doesn't include an additional battery, yet battery life is still excellent as you'll see in our benchmark results.

This is a 10.1-inch unit, as determined by

the size of the screen, and Asus has gone for a 1280 x 800 IPS panel. This is a big downgrade compared to the 1920 x 1080 screen found in slightly more expensive models, but it looks fine in action, with individual pixels hard to spot. Despite the slightly disappointing resolution, we love the image quality delivered by the IPS panel, with brilliant brightness, crisp and accurate colours, and excellent contrast ratio. It really is a new benchmark for image quality at this price point; heck, it even outshines laptop screens that are twice the price.

Asus has included a single USB 3.1 Type-C connector, along with another Type A and one Micro USB. Sadly the last two are only USB 2.0, a real shame given that Type-A USB 3.0 devices are now commonplace. Still, at least the Type-C will stand owners in good stead for future devices. Another Micro HDMI output

is included for patching into external displays, while a micro-SD card reader will be handy for boosting the anaemic onboard storage. The keyboard is a little disappointing though, exhibiting some rather serious flex, which is surprising given the metallic case, but it'll do the job for occasional emails and documents. The touchpad is also a little lacklustre, but thankfully the touch-enabled screen makes this a moot point, as it's accurate enough to do most of your basic navigation.

The inclusion of 802.11n is nice at this price, and there's also Bluetooth 4.0 as expected. We should point out the tiny charger that's included, weighing just 84 grams and connecting via Micro-USB. However, we did notice that when the battery was fully discharged, it would take upwards of 40 minutes of charging before the unit would power on, which could be an issue.

Powering it all is Intel's Cherry Trail Quad-Core x5-Z8500 processor, which has a zippy top-speed of 2.24GHz. This is fed via a 4GB of LPDDR3 memory at 1600MHz, a very healthy amount for a Windows 10 device at this price point. If there's one downfall though, it's the tiny SSD, measuring just 64GB at this price point. Having said that, Toshiba's Click also only comes with 64GB of storage, and that's a much more expensive unit. You can pay extra for the 128GB version of the T100HA, but we couldn't get pricing on this at the time of print.

Given the cheaper price of the T100HA versus the Click, its higher performance result in PCMark 8 Home's benchmark was a great surprise, posting 1581 versus the Click's 1277. This doesn't make it a game-devouring performance-pig, but the T100HA has ample oomph to handle multitasking of normal daily duties like email, web browsing and virus scanning. PCMark also turned in an impressive battery life of 282 minutes.

Toshiba's Click convertible blew us away last month, but this month the T100HA blows away the Click, being cheaper, faster and more rugged. The screen mightn't be quite as crisp, nor the battery life quite as impressive, but that's a small price to pay for such a huge drop in price.

Bennett Ring

KEY SPECS

\$529 • www.asus.com.au

10.1" IPS panel • Intel Quad-Core x5-Z8500 processor • 64GB eMMC SSD • 4GB LPDDR3 memory

OVERALL





Metabox Prime P870DM-G

HEAR THIS BEAST ROAR

Considering the power pack on this gaming brute weighs more than most ultraportable laptops, it's obvious that the Prime is not designed for prime moving. At almost 5kg in weight, this is a bruiser built to do one thing, and one thing only – kick major gaming butt. If you're looking for a high-end gaming laptop that has all the specs, along with a sky-high price tag to match, you've come to the right place.

While the innards of this thing are highly customisable, the exterior is locked as is. The huge 17.3-inch screen might only be 1920 x 1080, but it's got one rather important feature for gamers – Nvidia's proprietary G-Sync technology, along with a speedy 75Hz refresh rate. G-Sync really comes into its own on laptops, where their slower GPUs mightn't have quite the guts to tear through the latest games at 60 frames per second. With G-Sync enabled, it's possible to game at 45 frames per second and higher without it feeling sluggish at all... not that this machine needs to really worry about performance. The only issue we have with the IPS screen is that it's not quite as nice as the better IPS panels we're seeing elsewhere when it comes to colour and contrast. A matte finish means it won't turn into a mirror even in the brightest LAN environment though.

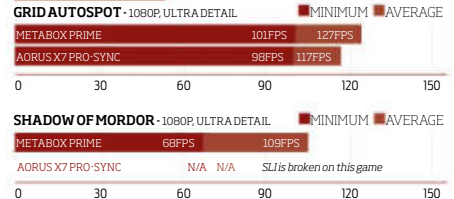
The huge base allows for a generous, full-sized keyboard, and there's

absolutely no flex at all, despite the chassis being made of plastic. The touchpad is similarly brilliant, being as accurate as it is responsive. Thanks to the huge dimensions, there are more ports than you'll know what to do with, including five USB 3.0, one USB 3.1/Thunderbolt 3 combo port, one HDMI 2.0 output, twin mini DisplayPort 1.2 outputs, headphone and mic jacks, an optical SP/DIF output, and finally, not one, but two Ethernet ports. The latter are delivered courtesy of Killer's DoubleShot Pro hardware, which can theoretically double the bandwidth to the laptop on a local network, or allow to different broadband connections to be hooked up. Intel's dual-band 802.11ac 8260 Wi-Fi chip is included, which uses a 2x2 configuration.

Despite the Sound Blaster X-Fi MB 5 sticker on the laptop, this machine actually uses Realtek audio hardware. We're not sure which version, but the Creative package is simply a software layer over the top – we found it was fine for driving a decent set of gaming headphones.

Where this thing really excites is the desktop-level hardware tucked away inside, which also explains the stratospheric price point. Intel's blazing fast i7-6700K 6th Gen Core processor tops out at 4GHz under load, which is more than enough for even the most demanding games, including CPU-taxing

BENCHMARKS



RTS titles like Company of Heroes. This is backed up by a chunky 16GB of the newest DDR4 memory, though it runs at the stock Skylake frequency of 2133MHz. Our sample came with a Samsung 850 EVO M.2 SSD that is 250GB in size, along with a secondary 1TB 7200RPM mechanical hard drive.

REAL GRAPHICS POWER

But the cherry on the topping has to be the Nvidia GeForce GTX 980. Notice how there's no sneaky M slapped onto the end of the GPU name? That's because this is the exact same chip as that found in the desktop GeForce GTX 980. There's no slowing down of clock-speed, no snipping off of Stream Processors, and none of the other shenanigans usually found in laptop GPUs. In fact, this laptop variant actually has an incredible 8GB of GDDR5, making it superior to the desktop part in some regards. There's a price to pay for this part, in the form of a 165W TDP... and that's just for the GPU alone. Under load, it measured 55dB on our sound meter, which is rather loud, if not quite as obnoxious as the 57dB heard with certain twin GPU laptops we've tested, such as the Aorus X7 Pro-Sync.

If you can handle the noise, the net result of all of this hardware is an utter speed demon of a machine. This is without doubt the fastest gaming laptop we've tested, besting even the twin GTX 970s found in the Aorus X7 Pro-Sync. Yet there are several compromises that have to be made to get this level of performance. We can handle the price, and the weight, but that fan noise is bound to get annoying after a while. Once again we wish the supplier included a set of noise-cancelling headphones in the box, but they'd have to admit upfront about how loud it was, something no marketing manager would ever allow.

Bennett Ring

KEY SPECS

\$4549 - www.metabox.com.au
17.1" 1920 x 1080 G-Sync display • Intel 6th Gen Core i7-6700K CPU (quad-core, Hyper-Threaded 4GHz) • 16GB DDR4 memory • 250GB Samsung EVO M.2 SSD and 1TB HDD

OVERALL





D-Link Taipan AC3200 Ultra Wi-Fi Modem Router

A PREMIUM ROUTER WITH MODEM FUNCTIONALITY

Now, this is a rarity. Premium modem routers don't come around too often, with the majority of high-end wireless routers still requiring a separate modem to provide internet connectivity.

The D-Link Taipan touts itself as the first consumer tri-band modem router, and a quick scan of the current marketplace justifies its claims. The other modem routers available to this point have been dual-band, with tri-band functionality only coming from premium wireless routers, sans modem capabilities.

It certainly has very striking looks, looking like an alien spaceship or an insect that's landed on its back. With its six high-gain antennae sprouting from its edges and its wide footprint, you'll definitely need to ensure there's plenty of desk or shelf space to accommodate it. Sadly, it isn't capable of standing on its side, but I suspect buyers of this product will want to show it off, rather than hide it away in the corner. The Taipan is visually almost identical to D-Link's DIR-890L, except that device is red and is only a wireless router, with no modem functionality.

On the back of the router are the usual suspects. There's a DSL port for your phone line, a USB 3.0 port, a USB 2.0 port, four Gigabit Ethernet ports (which can be used for WAN/NBN purposes) and a power button. There's also a reset button, WPS button and the power socket.

Setup of the router was a pretty simple process. Plug in all of your required cabling and fire it up. You can either configure the Taipan using a PC connected via Ethernet, or using a mobile device via wireless. All you'll need are your login credentials from your ISP, and the whole process takes all of five minutes. The Taipan auto-detects your internet connectivity settings, and you're up and running in no time.

During setup, you are given the option of specifying separate SSIDs and passwords for the 802.11n band and the two 802.11ac bands. However, I recommend that you give them all the same SSID and password, so you can take advantage of the SmartConnect functionality of the device. SmartConnect will automatically allocate any newly connected wireless devices to the best available band, to ensure the fastest possible connection speed.

Tested this functionality with four 802.11ac-compatible devices, it evenly distributed them across the two available 5GHz channels, and was able to send all connected 802.11n devices to the 2.4GHz channel without further intervention.



As for the rest of the web config page, navigating through it was a breeze, with basic settings initially shown, and allowing for advanced configuration should you wish to do so. The home page provides an at-a-glance look at the state of your network, showing internet connectivity, connected devices, and any USB devices also connected, be it hard drives or printers. You are also able to set up a mydlink account, which – when used in conjunction with an installed smartphone app (iOS and Android versions available) – can be used to remotely manage your home network, granting and revoking access to devices as required.

The Taipan claims to be a video streaming powerhouse, so I decided to test its claims. I wirelessly connected a 2015 MacBook, a Dell XPS 13, an iPad Air 2, an iPhone 6, an HTC One M8 and my LG 55in LED TV and started streaming a combination of Netflix and YouTube HD videos across all of the devices. Each device was quick to start their respective videos, and after a short wait on each, were all playing at the maximum available resolutions with no stuttering or lag. Quite impressive.

I then picked up the mobile devices and moved to the other end of the house, and there was no discernable drop in video or audio quality, even with the router having a handful of walls in the way. I suspect this has something to do with the AC SmartBeam technology, which uses built-in algorithms to direct its 5GHz transmissions to connected devices directly, rather than flooding the airwaves with signals in all directions.

It's definitely got the goods performance-wise, but with a price of \$579.95, it's a very expensive proposition. If you've got an ancient ADSL modem that's on its way out and high-speed media streaming is a must-have, then you might be able to justify buying the Taipan. However, if your modem works fine, you're probably better off picking up the DIR-890L wireless router and saving yourself almost \$200 in the process.

Despite its router + modem appeal, the D-Link Taipan AC3200 Ultra is just too expensive at this point to wholeheartedly recommend.

Anthony Agius

KEY SPECS

\$579.95 • www.dlink.com.au

Dual-core 1GHz processor • Tri-band (600n + 1300ac + 1300ac) • 4 x Gigabit Ethernet, USB 3.0, USB2.0

OVERALL



Apacer



PANTHER

A5330 SATA III 6GB/s SSD

***Fast, Furious,
Accurate- Dominate
Your PC World***



Features

- Outstanding speed, read 545MB/s; write 520MB/s(960GB).
- SATA power management.
- Powerful ECC of 72bit/1KB.
- SSD Widget software for status check.
- SATA connector cover for protection.

SYD

J & W computers
<http://www.jw.com.au/>

MWAVE
<http://www.mwave.com.au>

MEL

CPL
<http://www.cplonline.com.au/>

Scorpion
<http://www.scorptec.com.au>

PC CASE GEAR
<https://pccasegear.com>

QLD

Umart
<https://www.umart.com.au>

Gold Coast computer centre
<http://www.goldcoastcomputer.com.au>

PERTH

VTECH
<http://www.vtechindustries.com.au>

New Zealand

Mighty Ape
<http://www.mightyape.co.nz>

Playtech
www.playtech.co.nz

Xpcomputers
<http://www.xpcomputers.co.nz>

Just laptop
www.justlaptops.co.nz



Samsung Galaxy Tab S2 9.7in

THE TAB S2 DELIVERS QUALITY IN ALL THE AREAS THAT MATTER - IT'S THE BEST-VALUE LARGE ANDROID TABLET AROUND

There are certain things that you're guaranteed to get with the 9.7in Samsung Galaxy Tab S2. The first is quality. It's clear from the moment you pick it up that this is a premium tablet, with no hint of flex and a stylish, understated design. The second is speed. Inside sits an octa-core processor and 3GB of RAM, which combine to give slick performance in pretty much everything you do. And the third is a magnificent 9.7in display.

Even more impressive is that Samsung delivers all this in a tablet only 5.6mm thick. It's easy to let a stat like that wash over you, so let me emphasise the point: it means there's barely 1mm of metal above or below the headphone socket (which sits at the bottom of the device). In a world where we've come to expect truly remarkable engineering as a matter of course, it's, well, truly remarkable.

Naturally, the S2 is light too. At 389g, it's 10% lighter than the 437g Apple iPad Air 2. Just as importantly, the Galaxy Tab S2 feels well balanced in the hand, which is rather important if you're going to

watch films with it.

However, Samsung's designers need to have a rethink here. When watching video, my right hand's instinctive position meant my little finger covered one of the speakers while my thumb all too easily brushed the back button. This isn't disastrous, but it meant I had to position my hand in a certain way.

DESIGN AND SOFTWARE

I described the Tab S2 as understated, which could be seen as a backhanded compliment. Others might call the gold version a little dull and prefer the white or black versions, but it's certainly the colour I'd opt for if all prices are equal. That said, the black version tends to be significantly cheaper, as the gold version only appears to be available from a handful of retailers, such as John Lewis.

I initially liked the fact that Samsung is selling a keyboard cover to go with the S2. This cleverly clips into the two depressible buttons fitted into the Tab's rear. However, it's somewhat expensive at \$199.

This is a shame, especially when Samsung puts productivity at the forefront of the Tab S2. It preloads Microsoft Word, Excel, PowerPoint and OneNote, and that makes perfect sense with a large 4:3 screen. When paired with the right keyboard, this is a machine that

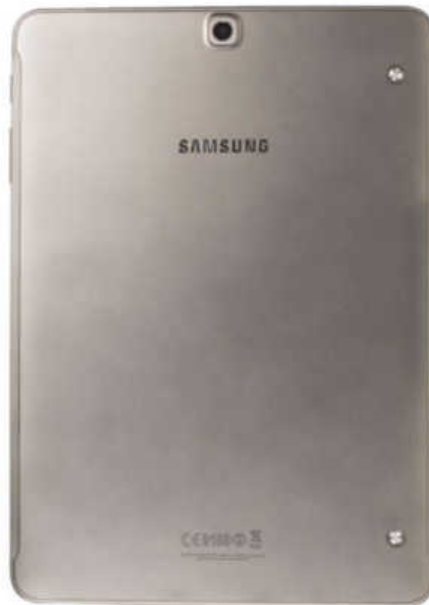
"In a world where we've come to expect truly remarkable engineering as a matter of course, it's, well, truly remarkable"

you can actually do things with.

As ever, Samsung can't help but add its own TouchWiz software layer over Android 5.0.2 (Lollipop), but the end result is easy to get to grips with. I still prefer vanilla Android, but TouchWiz isn't overly invasive.

SCREEN QUALITY

I've already nailed my feelings to the mast regarding the Tab S2's



“You can add up to 128GB of additional storage via the microSD slot, so opting for the 32GB model won’t be a decision you later regret”

▲ The display is one of the best out available

screen: it’s one of the best out there. Let me qualify that to an extent, though, as in its default setting (Adaptive display), some might find its vibrant colours a little too eye-popping. Naturalists will prefer the Basic mode, but, to my eyes, it turns everything a little drab.

That said, to get the best accuracy, you should switch to Basic. In this mode, it covered 100% of the Adobe sRGB gamut in our tests, and as it uses Super AMOLED technology, contrast is perfect. Naturally, it’s darned crisp too: that’s what happens when you pack 2,048 x 1,536 pixels into a 9.7in screen. That resolution translates into 264ppi – exactly the same as the iPad Air 2.

PERFORMANCE

The internals of the Samsung Galaxy Tab S2 9.7in are identical to its 8in sibling, the cunningly titled Samsung Galaxy Tab S2 8in, so it should be no surprise that the two perform almost identically in benchmarks.

For example, it scored 1,268 in the single-core Geekbench 3 test and 4,295 in the multi-core test – within a percent or two of its brother. While that put the Tab S2 8in in the upper echelons of compact tablets, it’s a more mixed result in relation to larger rivals. The iPad Air 2 scored 1,683 (33% faster) and 4,078 (5% slower), for example.

Its gaming benchmark scores were less impressive. I put it through its paces in GFXBench 3.1 and found it stumbled compared to the best tablets, typically rendering half the frames per second of the iPad Air 2 or the Nexus 9.

But, frankly, you can get lost in

▲ The S2 has a stylish, understated design without a hint of flex

benchmarks. What really matters is that this is a fast performer in all the areas that matter. It’s still more than capable of handling demanding games such as Hearthstone, and should power through web browsing, most games and whatever else you throw at it for years to come.

BATTERY LIFE

I was, at first, a little fearful to see that Samsung had opted for a 5,870mAh battery, significantly smaller than the Apple iPad Air 2’s 7,340mAh. In practice, though, it delivers: it lasted 12hrs 9mins in our video-rundown test, an hour and a half longer than the iPad Air 2. (Note: we’ve changed the brightness that the battery test is run at, so results in other reviews may not be directly comparable – however, we did retest the iPad Air 2.)

This is credit to the efficiency of the processor, which will switch to the lower-power 1.3GHz cores when it can afford to. If you’re playing games, then expect much worse stamina. Likewise, pumping the screen up to its full 359cd/m² brightness will drag life down.

I was also pleased to see little drop-off overnight. Traditionally a strength of iPads, the Tab S2 9.7in lasted a full week of light use between charges, with less than 1% lost while I was sleeping each night.

VALUE FOR MONEY

The 9.7in Galaxy S2 can be had for around \$540. At the same time, we’re seeing the Nexus 9 drop to sub-\$400 levels.

However, I’d still say the 9.7in has the edge on value for money. It feels and looks significantly superior, there’s 32GB of storage to the Nexus 9’s 16GB, and the screen is that much bigger and better. If you can buy the Tab S2 9.7in for less than \$500 the word bargain creeps to mind.

That’s especially true when you consider you can add up to 128GB of additional storage via the microSD slot, so opting for the 32GB model now won’t be a decision you later regret.

VERDICT

The Tab S2 9.7in isn’t a perfect tablet: gaming performance could be better, while a lack of accessories compared to the iPad 2 Air holds it back. Come on Samsung, make that keyboard cheaper!

However, Samsung hasn’t compromised in the areas that matter. As I did right at the start, I’ll come back to that screen and the build quality. Factor in the price, and the Galaxy Tab S2 9.7in becomes PC & Tech Authority’s top choice for larger Android tablets.

Tim Danton

BATTERY LIFE



KEY SPECS

\$540 • www.samsung.com.au

Octa-core 1.9GHz/1.3GHz Samsung Exynos Octa 5433 processor • 3GB RAM • 32GB storage • microSD slot • 9.7in 2,048 x 1,536 Super AMOLED display • 2.1MP/8MP front/rear cameras • dual-band 802.11ac Wi-Fi • Bluetooth 4.1 • 5,870mAh Li-ion battery • Android 5.0.2 • 1yr RTB warranty • 169 x 5.6 x 237mm (WDH) • 389g

OVERALL





Sapphire Nitro R9 380X 4G D5

THE AUSSIE DOLLAR DRAGS THIS PERFORMER DOWN

It's a tough time to be an Aussie component importer at the moment. With our dollar now buying just over 70 US cents, it's far costlier to import new products than it is to sell off the large inventories of products released six months ago that were bought on a much stronger dollar. And this is an absolutely huge issue for AMD's new Radeon R9 380X. Overseas it's priced to fill the niche between Nvidia's GTX 960 and 970, but as you'll see the value proposition simply isn't true here in Australia. But before we look at just how much our Aussie dollar has spoiled AMD's party, let's check out the card itself.

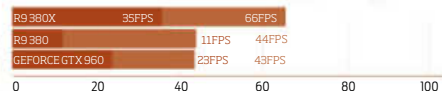
This is AMD's first desktop graphics card to use a fully enabled Tonga GPU, which originally landed in September of last year in the form of the R9 285. Built around AMD's Graphics Core Next (GCN) 1.2, the original R9 285 disabled four of the 32 Compute Cores found in the GPU, which went on to become the basically

identical R9 380. AMD did use a version of the GPU in laptops that finally unlocked all 32 Compute Cores in the form of the R9 M295X, but it's taken 14 months for Tonga to finally arrive on the desktop in a pristine, fully working format.

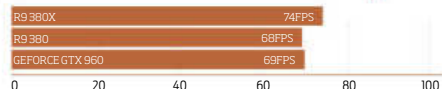
The new R9 380X has 2048 Stream Processors spread amongst the 32 Compute Cores, along with 128 texture units and 32 ROPs. The latter is just half that of the R9 390, as is the memory bus of the new card, at 256-bits versus the huge 512-bit bus of the 390. Yet the R9 380X isn't meant to compete with the 390, instead aiming to deliver a decent performance increase over the R9 380, which has 1792 Stream Processors and 112 texture units. Yet the Boost speed of the R9 380X is identical to the 380, at 970MHz. There's obviously a little room for overlocking though, as Sapphire's take on the product ships with a factory overlocked 1040MHz Boost speed. As usual, the GPU is built on the standard

BENCHMARKS

SHADOW OF MORDOR - 1080P, ULTRA DETAIL MINIMUM AVERAGE



GRID AUTOSPORT - 1080P, ULTRA DETAIL AVERAGE



28nm process of all recent AMD products, and there are 5 billion transistors used to build the GPU. This gives the R9 380X a TDP of 190W, though Sapphire lists its version as having a power consumption of 225W, likely a result of the overclock. It's fed by twin six-pin power plugs, and Sapphire suggests a 500W PSU as the bare minimum to supply enough juice for this card to thrive.

While most of the stats are identical to the R9 380 bar the slight increase in Compute Cores, the 380X does benefit from a doubling of memory. Sapphire has also overlocked this to 6GHz, and there's a healthy 4GB of the GDDR5 variety at play here versus the 2GB found on the 380 (there are 4GB variants of the 380 around, but the 2GB version was most popular). Sapphire cools all of this with its Dual-X cooler, a twin fan heatpipe that gives the card final dimensions of 238mm x 127mm x 41mm, making it easily fit inside a dual slot position.

It's a 0dB solution, meaning that both fans are disabled under light load, making it utterly silent. Even under full load it's a beautifully quiet creation, at just 42dB, making it hard to hear over the other fans in a PC. Sapphire has shipped this card with four outputs – DVI-I, DVI-D, DisplayPort 1.2a and HDMI 1.4.

Thanks to the use of a fully enabled GCN 1.2 core, the 380X supports all of AMD's latest features. LiquidVR should come in handy when next year's Head Mounted Displays finally arrive, as it aims to minimise motion-to-photon latency to under 10 milliseconds, though of course this gets worse as frame rates drop. It's obviously also compatible with AMD's FreeSync adaptive synchronisation technology, which means it'll work with any and all monitors that also display the Adaptive-Sync logo, which is an optional part of the DisplayPort 1.2a spec. Note we said optional – while most monitors with DisplayPort 1.2a should support FreeSync, it's not mandatory.

Now that Windows 10 is here, full support for DirectX 12 will come in handy, but we don't expect most games to make use of this until late 2016 at the earliest. When they do, expect a healthy performance increase just from the

DRIVER OVERHAUL

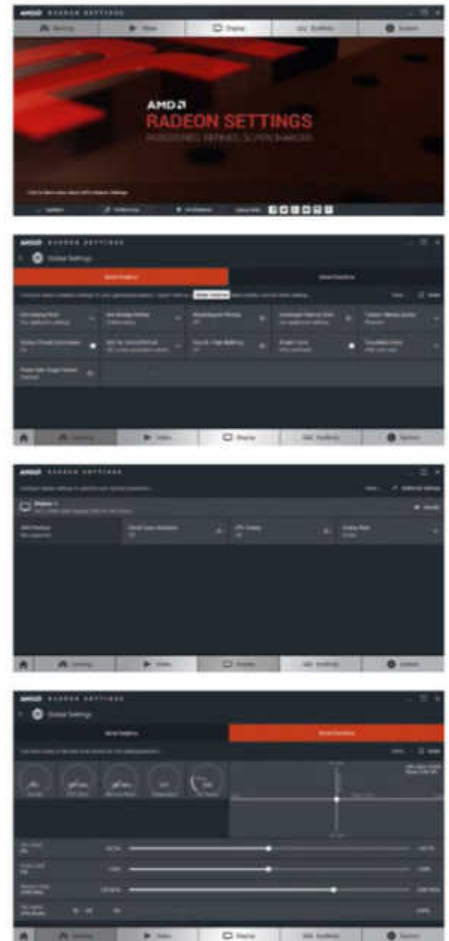
At the same time as the release of the R9 380X, AMD also unveiled the most comprehensive update to its graphics drivers that we've seen in years. Known as the Radeon Software Crimson Driver (why they didn't just call it AMD Crimson is beyond us), it's a top to bottom overhaul of the cluttered, sluggish AMD control panel of the past.

The first thing you'll notice is how quickly it loads, at just 0.6 seconds compared to seven or eight for the older version. It's also an absolute stunner, borrowing from the slick, minimal look favoured by web designers, which is immeasurably more pleasant to look at than the text-based menus of the older drivers. More importantly, it's much easier to find your way around in the new drivers, with large tabs for each major section.

The most important of these is the new Global Settings – Graphics option, which is used to house the various image quality settings that can be applied to games. If there's one complaint, it's that AMD doesn't provide descriptions of each setting, assuming instead that gamers will know the difference between enabling or disabling the Shader Cache, Surface Format Optimisation or Tessellation Mode.

A key new feature here is the Frame Rate Target Control, which is a huge improvement over prior versions. In the past gamers could only set their frame rate between 55fps and 59fps, which was next to useless. The new Crimson software opens this up to framerates between 30fps and 200fps, which is especially great for users with gaming monitors that support higher refresh rates. Crimson also allows all of the above settings to be customised per game, and it's a much easier process than previously.

While we love the look and feel of the new Crimson drivers, they didn't launch without issues. A fan bug saw some cards running with a fan speed of just 20%, which lead to overheating. Some isolated users even reported damage to their cards as a result. Thankfully AMD has since pushed out a fix for this fan issue, and as a result we'd happily recommend AMD users upgrade to the new drivers.



▲ AMD's all-new Crimson control panel is quicker and slicker, loading in just a fraction of the time the old CCC took, and being much nicer to use

it's just that stock of the older 380 were imported on a much stronger Aussie dollar. In comparison, it's possible to pick up a GTX 960 for just \$280. Even worse, the cheapest GTX 970 in Australia is the Gainward GTX 970, and it can be bought for just \$449. This card will run rings around the R9 380X.

As a result, there's simply no way to salvage the R9 380X in the Australian market. If our dollar rebounds and stock can be imported at a price comparable to overseas, then the R9 380X will be the sweet spot for 1080p performance. Unfortunately, at over \$400 for this model, it's terrible value.

Bennett Ring

KEY SPECS

\$419 • www.sapphiretech.com

28nm Tonga GPU; GCN 1.2; 4GB GDDR5 memory; DX12 compatible; 1 x DVI-I, 1 x DVI-D, 1 x HDMI, 1 x DisplayPort

OVERALL



switch in API, with some predicting a doubling in framerates.

Given the similarities to the R9 380, we didn't expect a huge increase in performance with the new card, and our benchmarks bear this out with one exception. While the 380X is around 10% faster in both 3DMark and Grid Autosport than the 380, it has a huge lead over its cheaper sibling in Shadow of Mordor, with the doubling of memory helping it to handle this game's huge textures. In all cases it outperformed Nvidia's GTX 960, which also has just 2GB of onboard memory.

Based on our benchmarks, it seems that AMD's claims that the R9 380X is perfect for rock-solid 1080p gaming at 60 frames per second seems true, whereas the 380 doesn't quite make this. And that'd be reason enough to consider the 380X if the prices were aligned. Sadly, they most certainly are not.

In the US, the R9 380X is just \$30 more expensive than the R9 380, at \$229 vs \$199, a small 15% increase. Yet over here, we're looking at \$419 for a 380X, versus just \$285 for the 380. That's a massive 47% increase, which totally decimates the whole point of this product. It's absolutely no fault of Sapphire or AMD,



Asus Maximus VIII Extreme

OVERKILL FOR SOME, A MUST FOR A MINORITY



Unless you've got a tank of liquid nitrogen stashed under your overclocking bench, the new Maximus VIII Extreme is absolute overkill for your needs. This \$800 Z170 motherboard is designed from the ground up for serious tweakers or those with money to burn who are looking for the ultimate home for their new 6th Gen Core processor. It's ludicrously over-specced, insanely expensive... and damn sexy in the process.

At the time this board was released, according to Asus it smashed eight world overclocking records, and just afterwards posted the world record 3DMark 05 score with an overclocked CPU speed of 6.4GHz. At the time of writing it was still going strong according to the World Record results at HWBot.com. This is an overclocking thoroughbred, designed for those few who need the absolute edge in performance.

It achieves this via numerous means. There's the usual high end capacitors and MOSFETs, along with dual PWM controllers. Based on the current overclocking results, it's obvious these all combine to deliver some of the most stable, clean power found on a tweaking motherboard, which helps when you're pushing a chip on LN2. Asus also includes the latest version of its OC Panel II, an external box that can be used to monitor and tweak the system. When used in an open testbench it can be propped up via its stand, but if you're installing this motherboard into a case, it also comes with a 5.25-inch drive bay adaptor.

Despite being aimed at the hardest of the hardcore, Asus has included an automatic overclocking mode with this motherboard. It's called 5-Way Optimisation, and it runs automatic benchmarks and tweaks until it finds a stable speed for your CPU. We've had nothing but bad luck with such systems in the past, but to our delight it actually worked well here, maxing out our i7-6700K at 4.7GHz, a nice increase over our quick and dirty manual overclock of 4.6GHz.

As for standard motherboard features, this thing is chockers with top-tier goodies. The onboard audio is exceptional, using a raft of high-end components to deliver absolutely hiss-free audio, and it can even power 600ohm headphones. Four full length PCIe slots are ready for quad AMD GPU setups, but just twin Nvidia cards due to the lack of bandwidth. Another two PCIe x1 are ready for other goodies. Networking is delivered via a single Intel I219V Gigabit Ethernet controller, along with integrated dual-band 802.11ac Wi-Fi.

The storage system on this board is rather unique. Along with the expected eight SATA 3 and twin SATAe ports, there's an M.2 port, running over PCIe 3.0 x4 for maximum speed. Of note is the inclusion of an NVMe U.2 port, used by the likes of Intel's new 750 series SSD. It's an interesting choice given how rare these drives are, but does free up space on the motherboard.

A stack of USB ports are included, with a total of four USB 3.1 (three Type-A,

one Type-C), along with four USB 3.0 on the rear panel and the option for four more via a header. DisplayPort 1.2 and HDMI 1.4a out are both included in case you want to make use of the Intel CPU's integrated GPU. Finally, four DDR4 slots are present, and Asus has rated them to handle speeds of up to 3866MHz, though we're sure tweakers will get even more out of it.

There's no denying this board is stuffed to the gills with features... but it's also a whopping \$800. There's simply no way we can justify this price unless you're going to push it to the limit via extreme overclocking. Even high-end gamers looking for a top-tier board will find similar specs, minus the crazy tweaking features, for a solid \$200 less. Stacked up against Gigabyte's similarly priced Z170 Gaming G1, the Gigabyte edges ahead with a better PCIe layout (it's able to do handle quad SLI), includes a Thunderbolt 3 port (the Asus only has a header), twin M.2 slots and, we think, better audio. Still, if you're looking to smash some world records, \$800 probably isn't too much to see your name on the top of the charts.

Bennett Ring

KEY SPECS

\$799 · www.asus.com.au

Z170 chipset; 4 x PCIe x16 slots; 2 x PCIe x1 slots; OC Panel II; Intel I219V Gigabit Ethernet and 3x3 Dual Band 802.11ac Wi-Fi

OVERALL



GIGABYTE™

Be pro. Be original.



Intel Inside®. Extraordinary Performance Outside.

ULTRAFORCE Professional Laptops

Get Your Works Done Faster with 6th Gen Intel® Core™ i7 Processor



14"

P34 GTX 970M 6GB

NVIDIA® GeForce® GTX 970M 3GB
Light & Slim: Only 1.71kg, 20.9mm
Full HD Display with Wide Viewing Angle
Dual Storage: up to 512GB M.2 SSD + 2TB HDD
Exclusive Supra-cool Technology



15"

P35 GTX 980M 8GB

NVIDIA® GeForce® GTX 980M 8GB
Light & Slim: Only 2.2kg, 20.9mm
4K UHD IPS Display (Optional)
Quad Storage: Up to Two 512GB M.2 SSD + two 2TB HDD
Exclusive Supra-cool Technology
Hot Swappable DVD-ROM/HDD Bay



17"

P37 GTX 980M 8GB

NVIDIA® GeForce® GTX 980M 8GB
Light & Slim: Only 2.8kg, 22.5mm
4K UHD IPS Display (Optional)
Quad Storage: Up to Two 512GB M.2 SSD + two 2TB HDD
Exclusive Supra-cool Technology
Hot Swappable DVD-ROM/HDD Bay
Unique Macro Hub for Quick Editing

PLACE TO PURCHASE

Affordable Laptops <http://affordablelaptops.com.au/>
Online Computer <http://www.onlinecomputer.com.au/>
MSY Technology <http://www.msy.com.au/>

Scorptec Computers <http://www.scorptec.com.au/>
JW Computers <http://www.jw.com.au/>
Kong Computers <http://www.kongcomputers.com/>

FragLabs <http://www.fraglabs.com.au/>
CPL <http://cplonline.com.au/>

MADE in TAIWAN

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www.gigabyte.com.au

Crucial BX200 480GB SSD

NOT AS CHEAP AS IT NEEDS TO BE

As SSDs continue to gain popularity and competition increases, their makers have had to come up with new ways to deliver even more affordable solutions. One answer has been the introduction of TLC NAND memory, which stands for Triple-Level Cell. This is a far more affordable type of memory than the speedy Single-Level Cell (SLC) and Multi-Level Cell (MLC) memory used in earlier drives, as it can store three bits per cell. Unfortunately, there's a trade-off, much slower write performance, and that's a rather large issue with the BX200.



To get around this, Crucial uses a 6GB high-speed cache, which serves as a buffer when copying files to the TLC memory. It's all controlled by the new Silicon Motion SM2256, and the cache basically acts as a smaller SSD within the drive. It's fine when copying files that are smaller than 6GB, delivering performance on par with other SSDs. The ATTO benchmark shows read speeds of up to 557MB/sec, with write speeds of up to 500MB/sec. However, as soon as you start copying files that exceed 6GB in size, which isn't uncommon in this day and age of 40GB 4K movie files and game installs, performance plummets. We did manual file copying tests to check this out, and measured a lowly 80MB/sec, a huge decrease compared to TLC and SLC SSDs.

This wouldn't be such an issue if the price of this drive was ridiculously low, but it's not. At \$239 for a 480GB drive it's going up against the likes of the SanDisk Ultra II, another TLC drive but

with a much larger SLC cache of 20GB. As such it won't hit the same limitations of the BX200 until you're copying files over 20GB in size, which is a much rarer circumstance. So unless Crucial can bring the cost of the BX200 well below competing drives, its smaller SLC cache makes it hard to swallow. The fact that smaller capacity BX200 drives have even smaller caches make these SSDs even worse value.

Budget SATA SSDs like the Crucial BX200 are increasingly important as supplementary drives now that next-gen PCIe and M.2 drives are taking hold – as long as the write speeds don't affect you.

Bennett Ring

KEY SPECS

\$239 • www.crucial.com

Endurance 72TB total bytes written (TBW), or 40GB per day for 5 years • 3 year warranty • SATA 3

OVERALL



Razer Mamba

THE PERFECT GIFT?

Let's face it – spending \$260 of your own money on a gaming mouse is rather insane. However, if you could get somebody else to pay for it as say, a birthday present, then it's not so hard to swallow, especially when it's a mouse as desirable as Razer's latest version of their famous Mamba. And if you give this as a gift, the luxurious packaging and presentation makes this one piece of hardware that is actually a joy to unpack, unlike the usual static bag and foam found in other products.

The first thing you'll notice about the Mamba is that it's wireless, which is usually a huge no-no in a gaming mouse. Serious gamers can notice latency when

using these, but we were amazed to find absolutely no lag between moving the mouse and our cursor moving on screen. It uses the same 1000Hz polling of other wireless mice, but this time around it actually seems to work. A USB cable is included in case you'd rather stick with this tried and trusted method of connectivity. The included charging base is as sexy as the mouse, as both are endowed with sexy RGB lighting that pulses and glows, yet remains remarkably subtle.

One thing that is absent is an abundance of buttons, with two thumb (right-handers only), two DPI and the usual Left/Right buttons. A small screwdriver is included to adjust the tension in the main buttons, a very nice touch. But what really makes

this mouse shine is the 16,000 DPI 5G laser sensor. We're big fans of optical mice for shooters, but found the laser in this beast on par with the best



optical sensors. Throw in some of the best software on the market, and that \$260 price point suddenly doesn't seem so unreasonable...

For the money you get the flashiest (literally!) mouse on the market, a fine piece of gaming and general purpose engineering, and that priceless feeling of pride every single time you look at it.

Bennett Ring

KEY SPECS

\$259 • www.razerzone.com

16,000 DPI 5G Laser Sensor • 210 inches per second/5G acceleration • 1ms response time

OVERALL



Huawei Watch

IT'S ATTRACTIVE, PACKED WITH FEATURES AND THE BEST ANDROID WEAR WATCH YOU CAN BUY

Let me beat around no bushes: this is the best Android Watch around, bar none. What lifts it above the rest isn't some major breakthrough – battery life, speed, an ultra-sleek design – but a collection of little details that edge it above the competition.

Take its looks. Compared to other Android smartwatches, the Huawei Watch has a slimmer bezel, thinner body and – the aspect so difficult to translate into specs and comparatives – it exudes style and sophistication.

Just like rivals such as the Apple Watch and the second-gen Motorola Moto 360, the Huawei Watch is available in a number of different “styles”. These range in price from a base of \$549 for the Classic with a standard black leather strap, up to \$649 for the Active version with a black-plated stainless steel link strap. There's even a rose-gold version of the watch.

There's no technical difference between the Active and Classic versions, colour aside, and whichever one you go for, it looks wonderful. I was sent the basic Classic with black leather strap, but even this cheapest version looks stunning, and what's more, it's extremely comfortable to wear.

It's the display that steals the show here, however. It measures 1.4in across and, with a 400 x 400 resolution, delivers the highest pixel density (at 286ppi) you'll see on any smartwatch. Most other Android devices have 320 x 320 screens.

Practically speaking, the difference



isn't huge, but it is possible to tell the difference if you look closely, and it's the details that count. It's only a shame so many of Huawei's 40 preloaded watch faces fail to take full advantage of this glorious screen, and are either cheesy or obviously computer-generated.

Still, the screen's a boon for watch-face addicts and anyone who likes to create their own faces via apps such as WatchMaker and Facer. And since the technology used in the screen is AMOLED, it makes a big impact, with inky black and vibrant colours the order of the day.

It will look good for a long time to come, too. The super-tough sapphire crystal glass screen is more often found on boutique, high-end Swiss watches costing many more times the price.

Inside, things are considerably less exciting. A 1.2GHz Snapdragon 400 provides the power, just like almost every other Android Wear device currently on sale. Then there's an equally predictable 512MB of RAM and 4GB of storage.

It connects to your phone via Bluetooth 4, has a heart-rate monitor and six-axis motion sensor for fitness tracking, while charging is taken care of by a magnetic, clip-on puck. This gets the watch from zero to 100% in just over an hour. There's also a barometer, which is used by the Huawei activity-tracking app to gauge how many stairs you've walked up and down in a day.

When it comes to responsiveness, it's smooth most of the time, with the odd stutter and hiccup. It's no different to any other Android Wear device in this respect, and the stutters certainly don't get in the

way of usability.

Battery life is surprisingly good. Despite a comparatively small 300mAh power pack – the same as the smaller Moto 360 opposite – it lasted almost two days, with the Always-on screen option activated and the brightness set to maximum during the day and minimum during the evening. I still found myself charging the watch most nights, just for peace of mind, but it will get you through two working days if you forget.

As for software, it sports the latest version of Android Wear, and this works as well as it does on any other Google-based smartwatch. The only difference here is that Huawei supplements the standard install with its own set of watch faces, plus a set of apps for fitness, activity tracking and heart-rate monitoring.

These look very attractive, but the only out of the ordinary feature compared to other Android watches is Huawei's stair-tracking function.

The one thing that might give you cause for concern is the price. The Huawei Watch is more expensive than any other Android Wear smartwatch. It's pricier than the second-gen Moto 360 and LG Watch Urbane, and its base model is \$50 more expensive than the equivalent Apple Watch. At least the premium models aren't as expensive as Apple's finest.

If you have an iPhone, the best smartwatch to own remains the Apple Watch. It does everything and more than the Huawei Watch, and isn't much more expensive (at least, the cheapest Sport model isn't).

If your predilection is for an Android smartphone, on the other hand, this is the best you can buy now. From its crisp, vibrant AMOLED display to its sapphire crystal glass top, and its slimline body to its high-end looks, it nails every aspect of the formula.

Jonathan Bray

KEY SPECS

\$549 • www.huawei.com.au

Quad-core 1.2GHz Qualcomm Snapdragon 400 processor • 512MB RAM • 4GB storage • 1.4in 400 x 400 AMOLED display • Bluetooth 4.1 • 300mAh battery • PPG heart-rate monitor • accelerometer | gyroscope • Android Wear OS • 1yr RTB warranty • 42 x 11.3 x 42mm (WDH)

OVERALL



✓ The watch charges via this magnetic puck, going from zero to full in just over an hour





Samsung Gear VR Innovator Edition for S6

CURRENTLY THE BEST TASTE OF VR - IF YOU OWN A GALAXY S6 PHONE, WHY NOT GIVE IN TO TEMPTATION?

This is Samsung's second Gear VR headset, but don't be fooled into thinking the Innovator Edition is some kind of follow-up – it's pretty much the same, only designed to fit a different handset. While the original Gear VR would only fit the Note 4, this version is designed for the Samsung Galaxy S6 and S6 Edge.

The Note 4 has a larger screen and a lower pixel density than the S6 and S6 Edge, which you'd think might make a difference. In practical terms, however, you'd struggle to tell the two apart. It remains a little blurry at times – you can see the pixels surprisingly clearly – but you stop noticing that very quickly.

Other changes? You can now charge the phone through the headset, if you're willing to be tethered via a cable to your laptop or the mains, and there's no visor covering the phone at the front, but that's about it. It's still finished in smooth white plastic and feels like a well-made piece of kit.

Unlike the Oculus Rift, the Gear VR headset is merely a shell for the Galaxy phone to fit in. All the heavy lifting is done by the phone – the Galaxy S6 or S6 Edge, in this case. Other phones won't fit and won't be detected. Once connected to the micro-USB dock in landscape mode and clipped into place, the phone chimes to let you know it's booting into VR mode.

Navigating around this brave new world of virtual reality is a breeze with the Gear VR. The menu is presented as floating

in front of you, and a tutorial instantly explains how things are done. Looking at menu items and touching the pad on the side of the headset selects them, while swiping your finger along a touchpad on the side of the headset allows you to control menus, and even movement in the virtual-reality version of Temple Run.

“Although the headset provides full head-tracking technology, there's no connection with the rest of your body”

There's a back button on the side, too, which will always bring you back to the main menu should you need it, and even allows you to see out of the phone's camera, so you can tell if people are pulling faces at you in the real world.

Setting up a Bluetooth gamepad isn't controlled through the headset. This isn't required for everything, but any games beyond the superficial require titles one. Samsung sells its own game controller, but any Bluetooth pad will suffice – in theory. You can connect a PlayStation 4 pad to the Galaxy S6, but I found it was prone to strange key mapping and – worse – it occasionally got stuck and I found myself spinning on the spot. A Nexus Bluetooth pad fixed the problem

▲ The image remains quite blurry at times, but you soon stop noticing and opened up a host of meaty gaming experiences.

The apps all come from the Oculus store, which is integrated with the headset. Samsung suggests you set up card details beforehand, but don't get too excited: the store remains pretty barren. There's a strange mix of glorified tech demos and existing companies trying to find their feet in the strange new world of VR (including Netflix, complete with a virtual living room in an exotic wooden cabin). The various video demos are more impressive, usually used to promote films. For example, the Jurassic Park scene sees a brontosaurus coming so close you have to fight the flight reflex.

The game Dreadhalls also impresses. As a slow-paced horror game, it taps into the paranoia of wanting to constantly look over your shoulder. The downside of the tech soon becomes apparent here, however: although the headset provides full head-tracking technology, there's no connection with the rest of your body. This means you have to adjust which way you're facing using the gamepad, which can lead to a strange disconnect between the way you're physically facing and the way you're looking in-game.

But I'm nitpicking and this is, to an extent, just the growing pains of a completely new technology. While there aren't any truly phenomenal gaming experiences available yet, the Gear VR Innovator Edition for S6 is a great taste of things to come, and it's clearly different enough to be a game-changer.

Before you buy, though, note that the Oculus Rift is set to arrive in early 2016. Still, VR is an exciting technology and the Gear VR is currently the best way to experience it. If you want to be at the cutting edge, buy one.

Alan Martin

KEY SPECS

\$149 • www.samsung.com.au
Accelerometer • gyro sensor • proximity sensor
• 196 x 98.5 x 82.5mm (WDH) | 420g

OVERALL



PHANTOM-S

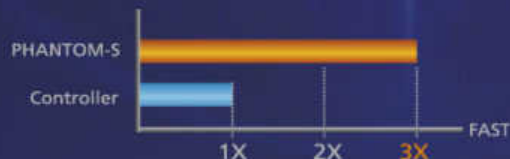
GAMEPAD EMULATOR

Can't Aim and Shoot Fast Enough or Accurately When Playing FPS Games on PS4, PS3, XBOX 360 or XBOX One?

PHANTOM-S™ IS THE ANSWER !

The PHANTOM-S™ uses signal conversion technology for advanced control during gameplay. You can abandon the conventional controller for FPS games to enjoy smoother movement, enhanced accuracy, customized controls and rapid fire with a PC keyboard and mouse.

The PHANTOM-S™ allows you to easily become a top FPS player with customized keyboard and mouse controls like you've never experienced. Whether you're a professional PC or console game player, the PHANTOM-S gives you the advantage.



Aim Better



Provides More Accurate
Rapid fire

Regular Software Updates



Provides New Features and
Boosts Performance

Unique Play Mode



Use a Laptop / Desktop keyboard
to control your game console



More about PHANTOM-S™
www.aten.com/phantoms



Shop now > **PC CASE GEAR**
www.pccasegear.com

Labs Apps

Magpie

\$0.99 · iOS

Apps that save web pages for later reading are common. There's Instapaper and Pocket, both of which are cross-platform. And there are also built-in versions, such as the Reading List apps in Windows 10, iOS and OS X. But there isn't anything that does a similar job just for video.

That's where Magpie comes in. It works on iOS (both iPhone and iPad are supported) and OS X, and it has a tvOS app so it'll also work on the latest Apple TV. Whenever you're watching a video in Safari (or any other app that supports the Share menu), you can use the Extensions menu to save it to Magpie. If it's hosted on YouTube or Vimeo, you can watch it in Magpie's native player, which does smart things such as preserving the place you've got to in a video across platforms. If the video isn't hosted on either of these platforms, it saves a bookmark to the whole web page, meaning that you can revisit the page later.

What it doesn't do is save the video for offline viewing, so don't expect to be able to pack your Wi-Fi-only iPad with YouTube videos to keep the kids amused on a long car journey. This makes it much less like Instapaper or Pocket, both of which save text articles for reading offline. It's also worth noting that the OS X application will cost you additional money, so if you want to save from the Mac for later viewing on your iOS device, you'll have to invest more.

✓ If the video is hosted on YouTube or Vimeo, you can watch it on Magpie's player

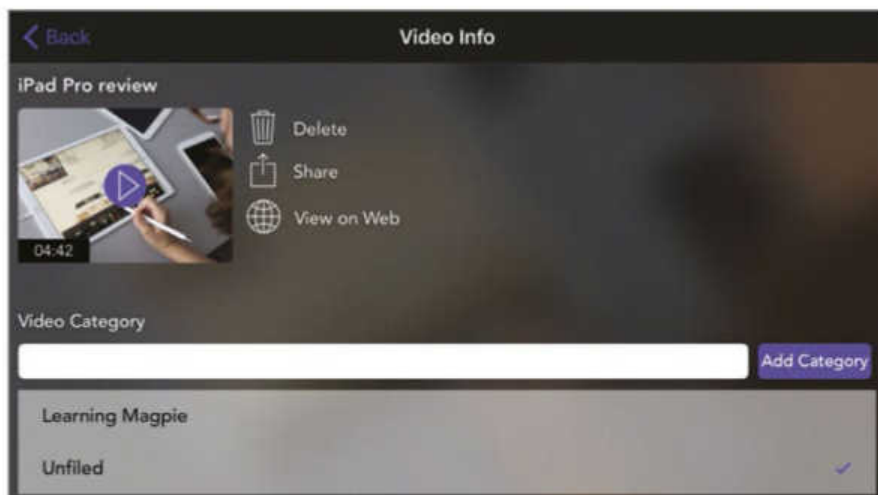
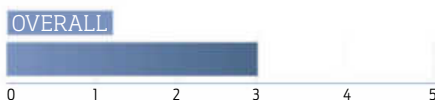
"It's certainly nice to start watching a video on the iPad and then move to Apple TV, picking it up at the exact same point"

There's also no free bookmarklet to let you save just from Safari.

In use, Magpie works exactly as promised. It's certainly nice to start watching a video on the iPad and then move to Apple TV, picking it up at the exact same point. However, because Apple has chosen not to build browsing capabilities into Apple TV, this only works for YouTube and Vimeo videos.

At present, Magpie is a promising application that's not quite a must-have for your devices, unless you watch a lot of YouTube videos and like to be able to bounce between platforms. It would be good to see the list of video providers that the player supports increased, and if Magpie could also offer offline viewing by caching the video locally, it would be a highly recommended product. At the moment, though, Magpie is useful for a handful of people, but probably not a product most users should invest in.

Ian Betteridge



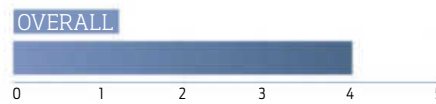
DSCO

FREE · iOS

This app from VSCO lets you make GIFs, add simple filters and share via VSCO and your social network of choice. Point the camera, hold down the screen and you'll record a looping clip of up to 2.5 seconds. After you've published, the GIF will be saved on your camera roll both as a GIF and an MP4 video.

In practice, it works a bit like a cross between Vine and Snapchat – with a simple user interface that lets you hit the ground running. The app's minimalist design can sometimes be confusing, but there's something charming about jittery GIFs that keeps them popular on the internet, and this app is a useful tool for making your own.

Thomas McMullan



TunnelBear VPN

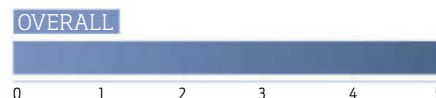
FREE/\$5.99/m · Android and iOS

Some VPN apps can be confusing. Very confusing. Some VPN apps can be buggy. Very buggy. Well, luckily this one is simple to understand and it works well. Very well. Bravo, TunnelBear.

TunnelBear VPN comes with a free tier that grants you access 500MB of data per month. That means you can download and watch the equivalent of an hour's worth of video on your Android device before your credit runs out.

Luckily, the paid version of the app isn't too steep: unlimited use for any five computer, smartphone or tablet devices will cost you a reasonable \$5.99 per month.

David Court



The Pickle Index

FREE • iOS

Equal parts pickle-based cookbook and absurd interactive novel, The Pickle Index is a strange, mysterious tale of a circus troupe on a journey to rescue its imprisoned ringleader. Each day you'll be encouraged to amp up your "Citizenship Quotient" by reading and uploading pickle-based recipes, and, in doing so, you'll stumble through a memorable tale of fermentation and totalitarian regimes.

The Pickle Index is not an ebook, it's not a game and it's not a social network, but it takes strands from all of the above and weaves them into an unforgettable oddball caper.

Thomas McMullan



OVERALL

0 1 2 3 4 5

Google Translate

FREE • Android and iOS

Chances are that you won't be able to learn every word of every foreign language when you travel, and that's where Google Translate comes in. At first, this may seem overkill - everyone knows you can get stiff and stilted direct translations online, so why the need for an app?

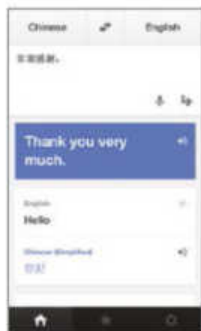
Simply because the Google Translate app throws in a bit of magic to the mix: point the camera at text, and you'll get the translation right there in front of you on your screen, with no need for fiddly typing and inevitable typos.

Sure, the translations aren't flawless, but it's enough to tell if the dish you're about to order will trigger your seafood allergy.

Alan Martin

OVERALL

0 1 2 3 4 5



- ✓ The keyboard allows you to drop in links, bullet points, hashtags and pictures

Several things about the Pencil show off Apple's attention to detail. The cap, which covers the Lightning plug which is used to charge it, has a small metal ring and snaps to the top in a really satisfying way. The cap also has small holes in it. These are there for a single reason: child safety, so that if swallowed, air can get through.

iPad Pro or MacBook?

In real world uses, the iPad Pro is subjectively faster than the MacBook. In benchmarks, too, the A8X blows the Core M used by the MacBook out of the water. Take a moment to think about that: Apple's latest "tablet" blows its latest "laptop" away.

On one level, we all knew that there would come a point when Apple's A-series of processors would overtake the low end of Intel's chips, but to have it actually happen is an amazing inflection point.

And this raises a question: if you're the kind of person considering a MacBook, should you look at the iPad Pro instead?

Creation and consumption



1Writer

FREE • iOS

Markdown text editors are scattered across the App Store, but editors that work well with iOS 9, iPad, iPhone and iPad Pro are much rarer beasts. 1Writer is currently probably the only one - and, thankfully, it's also exceedingly good.

1Writer has many similar features to competitors such as Byword and Ulysses. There's a keyboard with an additional layer of buttons that let you drop in links, bullet points and images. Images are automatically uploaded to Dropbox, CloudApp or Dropped, and files are synced to Dropbox or iCloud. You can even choose to have different folders of documents on different services, if you prefer.

Twitter addicts will appreciate the option to include hashtags in docs. The file browser will list all the hashtags used across your documents, letting you jump to any document including that term. You can create to-dos within a document and export all of them to Reminders, which is incredibly useful for anyone taking notes

- ✓ The 1Writer app makes it easy to automate tasks such as posting to Medium



in a meeting.

The killer feature for 1Writer is its automation capabilities. Unlike competitors such as Editorial, which uses Python as a way of building extensions, 1Writer uses JavaScript. Obviously, JavaScript is extremely well known, with a broad developer base. On the other hand, it's not as powerful as Python. For example, it can't access the native Twitter features in iOS, which is possible with Python.

That said, it's still capable of doing amazing things. Check out the 1Writer Actions directory and you'll find Actions that automate complex tasks such as posting to Medium, sending to Pastebin, as well as simpler stuff such as finding and replacing text.

The drawback of Actions is that there's no easy way to access them. All Actions live under a single modal pop-up, and you can't add them to a quick-access option on the keyboard. This means they're less useful for jobs you're likely to perform frequently.

1Writer is a well-thought-out and powerful text editor, which will only get more powerful as users expand its capabilities with Actions. It's not perfect, but if you want a text editor that makes the most of iOS 9, it's your best choice.

Ian Betteridge

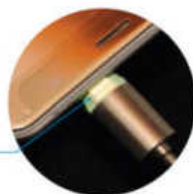
OVERALL

0 1 2 3 4 5

Labs Briefs

VIPOWER Dual Reversible USB to MicroUSB LED Cable

\$15 • www.auspcmarket.com.au



We're excited about a USB cable! And with very good reason. Get this: it's reversible at the standard-sized USB end. So no more getting it wrong and getting mad. But, it's also reversible at the microUSB end. Amazing. This now lives in my phone charger on my desk, and the first time I plugged the phone it this little magic cable revealed its other party trick. Being, it glows and changes colour depending on your device's battery state. Red for charging, blue for quick charging (as long as your phone supports high-speed charging, otherwise known as Quick-Charge 2.0) and green when the device is fully charged. Why couldn't we have this ten years ago?

Local shop AusPC Market found these in Hong Kong and brought a bunch over. For under \$15 delivered it's a bargain. It comes in 20cm, 50cm and 100cm lengths. There's also one with a USB Type C at one end.

I'm calling it: Coolest USB Cable Ever.

Ben Mansill

OVERALL



Aten Phantom S

\$90 • www.aten.com/phantoms

This allows you to utilise a PC USB keyboard and mouse with your console, and is compatible with Xbox 360, Xbox One, PS3 and PS4.

There are three rear microUSB ports for console, PC, and power – as the PC port does not power the unit. The front USB ports are for your mouse and keyboard, as well as a controller that you can switch to with a single button press.

Most of the set-up boils down to plug and play, however the device must be connected to a PC to alter mouse settings on the device, such as DPI and dead zone. Extra steps can be taken as well with the device's software to change button mapping, even allowing for button macroing that games wouldn't otherwise allow. A good solution for when a controller's customisation and DPI limits you, or you're more comfortable with keyboard and mouse in general.

Chris Pirina

OVERALL



HyperX Savage USB 3.1

\$99 (64GB); \$129 (128GB); \$259 (256GB)
• www.hyperxgaming.com

There was a time when a USB drive was a dull, unspectacular thing.

Then along came speedy SSD controllers, and insane amounts of capacity. Here's the latest chapter in the story. With this one, it's all about the USB 3.1 gen 1. Via this interface the HyperX Savage USB 3.1 gen 1 benched at 350MB/s read and 160MB/s write. That's damn near as close as you'll see to a SATA SSD plugged straight into the motherboard.

Because it falls under Kingston's HyperX gaming brand, you also get a little extra style to go with your data, with a big red X letting the world know you take the extreme path with your data on the go.

Ben Mansill



OVERALL



Transcend StoreJet 25S3

\$29 • www.transcend.com

What to do with the old SSD you bought for your PC, which has now fallen by the wayside as cheaper, bigger and faster drives begin to fill your box? Sticking it in a nice aluminium drive enclosure like the Transcend StoreJet 25S3 is one nice way to put it to work in its new life as an external portable SSD.

This is a bit more than a box for your SSD. The USB 3.0 interface ensures you won't be wasting that lovely SSD speed. Transcend also include the Transcend Elite set of data management tool (via a download), and that includes encrypted security protection, should you wish to use it. No AC adaptor is needed, as it draws all the power it needs from the single USB cable.

Another nice 'extra' is a button that can be configured as either a one-touch backup (using Transcend Elite) or to safely remove the drive from Windows.

Ben Mansill

OVERALL



Turtle Beach X-Wing Pilot Headset

\$75 • www.turtlebeach.com.au

If you're a rabid Star Wars fan, and you're not particularly picky about audio, then these Turtle Beach-powered cans could be your favourite headset ever. If, on the other hand, you care about audio – and build quality for that matter – we'd heartily suggest you look elsewhere. Made of the cheapest plastic, and with the barest of padding, they're uncomfortable in the extreme, and sound quality is distinctly lacking. In games, explosions and other bass-heavy effects feel flat and lifeless, and musical reproduction is similarly void of nuance and depth. Added to the fact that they literally creak and crack and the merest movement, beyond the branding – and even that looks pretty poorly executed in reality – there's almost nothing positive to say. Even the asking price seems too much given what's out there. There is simply no force that could awaken our desire for these headphones.

David Hollingworth

OVERALL



Panasonic HX-A1

\$299 • www.panasonic.com.au

We're rather fond of Panasonic's range of compact digital cameras, but the new HX-A1 is a whole new breed. It's an action cam, designed to take on the likes of GoPro, and while Panasonic's delivered some cool features, overall it's not going to compete just yet.

Its best feature is a night vision mode that works really well, so if you're fond of action in the dark, the HX-A1 is actually a pretty good deal. And it comes with an accessory that lets it use any of GoPro's standard mounting options, another plus. The HX-A1's design does limit its usefulness in a chest-mount, however.

But it as a camera, it suffers. There is a lot of artifacting, and colour replication can be very hit and miss, while images are generally quite fuzzy. You're also locked into a single 29.97 frame rate for HD shooting. There are also no water-proofing accessories, which is pretty limiting. Battery life is similarly limited, lasting only a touch over an hour. There are options to extend this, but they cut down on the utility of the camera. The nightvision is solid, but otherwise there are better options.

David Hollingworth

OVERALL



Corsair 600Q

\$219 • www.corsair.com.au

Corsair is not the first case manufacturer to turn case design on its head, but it is the first to combine an inverse motherboard tray design with a quiet computing case, making for a striking yet elegant design.

The 600Q is a little on the short and squat side, with a wide chassis made rather heavy and solid by a layer of sound-dampening material on nearly every internal surface. To make heat easier to handle – which is always an issue in quiet cases – the PSU sits above an inverted motherboard, and in its own discrete thermal zone, separated from other components by a plastic chassis.

The front fascia is very minimal, with a hinged door covering the optical drive trays. The upper panel has a three-speed fan controller along with the usual IO and power controls, and cooling comes via two large fans. There's a lot of filtering on the case, too, to keep dust out.

It's a great case if you want lots of interior room, little noise, and value elegance over bombast.

David Hollingworth

OVERALL



Belkin Qode Ultimate Light Keyboard

\$149.95 • www.belkin.com.au

Belkin is practically synonymous with Apple accessories. The company makes everything from chargers, to cases, cables, and more. Its latest is a keyboard/case for the iPad Air 2, and it manages the impressive trick of standing out in a very packed market.

It's the lightest iPad keyboard we've ever used, which means that you're not adding too much bulk to your wonderfully light tablet. The outer body is plastic, and not the most attractive, but it does get the job done, and the aluminium finish around the keyboard makes for an almost Macbook Air-like feel. But most importantly, it's very good to type on, with well-spaced keys that are easy to use accurately, and an array of functions that make document creation and editing on your iPad a breeze. Cut and paste, copy selection, media controls, and more make your iPad feel like an ultraportable, and the case still gives you access to all iPad's ports. And all that for just \$150, which is \$50 less than most tablet keyboards. If you type a lot on your iPad Air 2, this is almost an essential accessory.

David Hollingworth

OVERALL



NAND of hope and glory

WE TEST LOADS OF NEXT-GEN SSD TECH, FROM M.2 DRIVES TO PCI-E CARDS, TO FIND THE BEST SOLID STATE PARTNERS FOR A MODERN SYSTEM

When Intel launched the Z97 chipset, motherboards started to feature a new type of connector called M.2. Its main use so far has been for SSDs, with one of the main advantages being its ability to carry data across either the SATA or PCI-E bus, with the latter offering the potential for much faster transfer speeds than you can expect from a standard 2.5in SATA SSD.

M.2 storage devices are much smaller, squeezing the NAND flash, controller and memory cache onto a stick that measures 22mm wide and (usually) 80mm long. The connector delivers both power and data, and needs no extra cabling, enabling you to fit a whole PC into even smaller cases, or entirely remove the drive caging from your chassis, giving you extra room for water-cooling kit, or whatever takes your fancy.

There's more to M.2 though. Along with this new form factor, a new bus protocol called NVMe has been designed to replace AHCI, a standard introduced over ten years ago for connecting storage devices to a PC. It supports much longer command queues, and reduces overheads for superior transfer speeds and lower latency. At this early stage, M.2 complements rather than replaces traditional SATA ports, but it also co-exists with PCI-E add-in cards, which can offer the same faster speeds.

These new standards, connectors and device sizes have made PC storage more interesting, but also a little confusing. As such, over the next few pages, we'll not only review several M.2 and PCI-E SSDs, but also explain how M.2 works and the differences between drives.

Matthew Lambert and Orestis Bastounis

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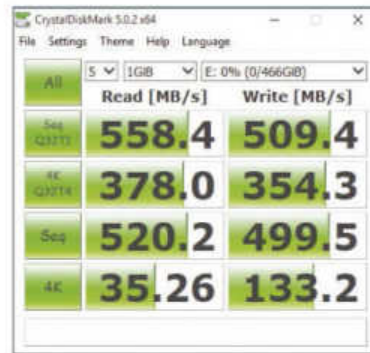
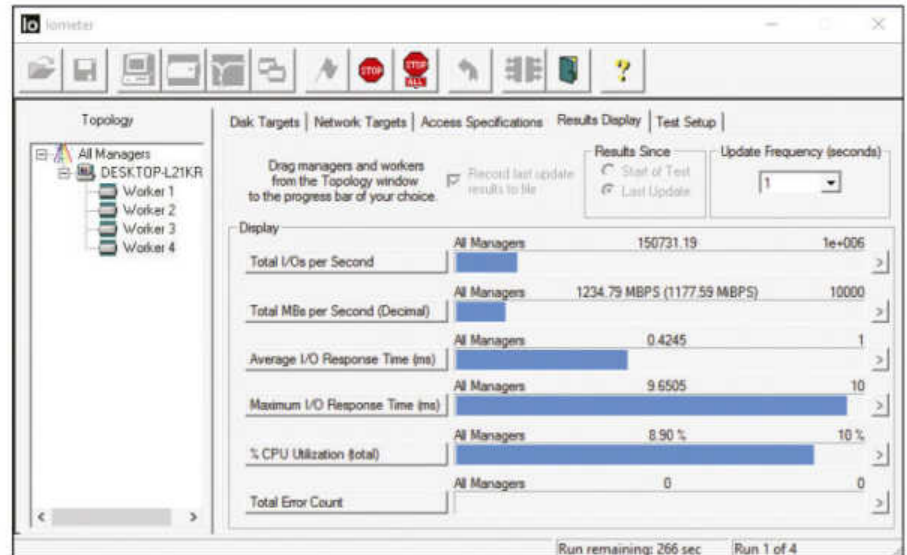
How we test

There are many facets of SSD performance that can be assessed. Our own battery of tests comprises synthetic benchmarks, trace-based storage workloads in PCMark 7 and PCMark 8, boot time measurements and Iometer's I/O workload generator. Prior to testing, we issue an ATA Secure Erase command to each drive using the SSD's software package if available, or with the Parted Magic (www.partedmagic.com) Linux build if not. This procedure erases all data and resets the SSD to factory performance.

We first run the synthetic benchmark CrystalDiskMark 5.0.2 to give us a quick overview of a drive's peak sequential and random performance, at queue depths of one and 32 – the former is the most relevant to regular users, but the latter pushes most drives to their true peak performance. You can easily run the benchmark yourself to compare your own PC's storage performance against the drives on test. We use the default settings, but set the 32-queue-depth random test to use four CPU threads to maximise the load on NVMe drives. Each test is automatically run five times, and we report the average.

For real-world testing, we first use PCMark 7's Secondary Storage benchmark, which loops three times and averages itself. It uses recorded SATA traces (the exact traffic over the SATA bus at the time of recording) to simulate performance in seven different ways, including Windows programs, adding pictures and music, video editing and gaming. It then generates an overall score based on the time taken to complete the tests. Next up is PCMark 8, which again uses traces, but with more modern programs. We've selected the Photoshop Heavy, Battlefield 3 and Microsoft Word tests, with the results this time being the time taken to complete the trace. All PCMark results include idle disk activity time, just as you would expect to see in real-world use.

Next, we move to Iometer. We generate four 64-queue-depth, four-threaded workload patterns (database, file server, workstation and web server) designed to simulate extremely heavy sustained use scenarios with different file sizes and write-to-read ratios. We run each test one after the other for five minutes, each using fully random data – easily enough



▲ Our SSD test suite includes Iometer, CrystalDiskMark and BootRacer

to stress a modern SSD controller. The number reported is the average IOPS (input/output operations per second) of all four tests.

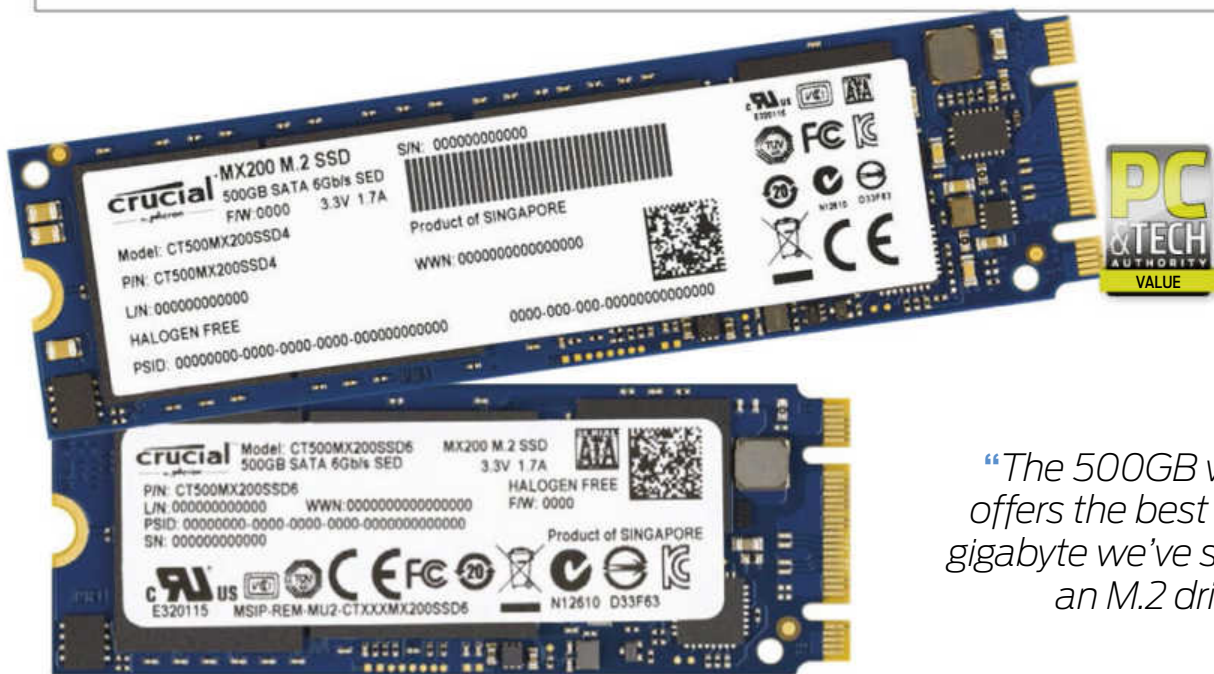
The last test times how long it takes to boot a clean Windows 10 64-bit installation using the freely available BootRacer, which measures boot times down to a thousandth of a second. We install the chipset, graphics, USB and audio drivers and reboot the system five times to allow Windows to get its caching in order. We then take an average of five cold boot times, which involve restarting the system and a full reloading of the operating system with all necessary

drivers and services. Next, we take an average of five fast startups, which is the default behaviour following a shutdown (different to resuming from standby). Here, Windows has saved the kernel and loaded drivers into the hibernation file (hiberfil.sys), which it then loads back into system memory when you boot up – for this part, only the loading of the desktop environment is timed.

All tests are performed on an MSI X99A Godlike Gaming motherboard using an Intel Core i7-5960X and 16GB of G.Skill RipjawsV DDR4 RAM. All CPU power-saving features have been disabled for testing.

THE SCORES

The speed score is taken from a weighted breakdown of the performance tests. CrystalDiskMark accounts for 20 per cent of this score (with a heavier weighting on low-queue-depth results), while 70 per cent of it is allocated to the PCMark 7, PCMark 8 and BootRacer real world tests, as they're the most relevant for everyday use. The final 10 per cent comes from Iometer, as the sustained high-queue depth workloads are only applicable to the most hardcore professional and workstation users. The dollars per gigabyte (\$/GB) score is then based on the pricing at the time of writing over the accessible formatted capacity, while the bang per buck score is essentially a ratio of the speed and \$/GB metrics.



"The 500GB version offers the best cost per gigabyte we've seen from an M.2 drive"

Crucial MX200 M.2

The 2.5in versions of Crucial's MX and BX SSDs have proved popular, with the BX100 occupying a well-deserved slot in our Elite list for its excellent value and bang per buck. There are some small differences between the MX and BX lines, of course. While both series are good choices for a price-conscious PC builder, the BX is the value option, with a relatively bare bones set of features, while the MX offers extras such as hardware encryption and a form of power-loss protection. With the M.2 variant, Crucial has taken the simple approach of squeezing the desktop 2.5in MX200 into an M.2 form factor, with the same controller and features.

It's a single-sided 2280 SATA drive with a Marvell 88SS9189 controller and 16nm 2-bit MLC NAND flash; not surprisingly, this is made by Micron, Crucial's parent company. The encryption and power-loss features carry over to the M.2 version as well. While the single-sided 80mm version is the drive on test, Crucial also sells 2260 double-sided variants, with the part name CT6997545, and there's also an mSATA version. Across all these form factors, 250GB and 500GB are the two capacities on offer.

Like its 2.5in siblings, the M.2 versions are very reasonably priced, with both the 250GB and 500GB drives being the cheapest drives on test. The 500GB version offers the best cost per gigabyte value we've seen from an M.2 drive, but whichever capacity you choose, there's only a small premium for opting for the M.2 version over the regular 2.5in SATA form factor, which is good to see.

Like the Samsung 850 Evo M.2 drives, an SLC cache plays a part with the MX200 M.2 drives; in Crucial's case, this is called Dynamic Write Acceleration. Unlike the fixed-size cache with Samsung's drive, with DWA the MX200 firmware grows and shrinks the cache as the free space on the drive changes. This feature was only present on the 250GB version of the 2.5in drive, but both capacities use it for the M.2 version.

Meanwhile, Crucial's SSD management software, called Storage Executive, isn't quite as polished or feature-packed as Samsung's offering, but it still offers a great visual UI and the usual functions such as firmware updates, secure erase and SMART information.

In our tests, with the exception of 32-queue-depth sequential read, the MX200 comes out marginally behind Samsung's 850 Evo, with both drives performing considerably better than the alternative SATA-based M.2 SSDs – the Transcend MTS800 M.2 and Kingston SSDNow M.2.

It's a trend that continues with the other tests. In (most of) the PCMark traces, the MX200 M.2 and 850 Evo M.2 are almost neck and neck, while in Iometer, the average IOPS from the MX200 drives is slightly in front, but again, both the MX200 and 850 Evo drives achieve considerably better results than the alternative SATA M.2 drives.

This combination of good performance and value for money translates to great bang per buck from the Crucial

MX200 M.2. There isn't a huge difference between these drives or Samsung's 850 Evo drives, but both are clearly one step ahead of competing SATA-based M.2 SSDs.

CONCLUSION

The Crucial MX200 M.2 and Samsung's 850 Evo M.2 are so close that they're practically indistinguishable from each other, meaning that either series of drives will be well suited to a budget system. However, the Crucial's lower price just edges it into award territory. The 250GB MX200 M.2 is by far the cheapest M.2 SSD on the market, while the 500GB version has the best cost per gigabyte ratio we've seen. The MX200 series might not offer the fantastic speeds of the latest PCI-E and NVMe drives, but if you're looking to save space on drives and cabling, they offer well-performing SATA M.2 storage for a very reasonable price.

VERDICT

The cheapest M.2 drive series on test is also a great performer, making it our best budget M.2 buy.

OCZ VECTOR 150 240GB - \$130

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
31/50	18/20	27/30	76%

CRUCIAL MX200 M.2 500GB - \$260

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
31/50	19/20	30/30	80%



Intel SSD 750 Series 1.2TB

Intel beat Samsung to market with a PCI-E 3 NVMe SSD in the form of the 750 Series. It comes in either a half-height, half-length add-in card format, or in a 2.5in case with an SFF 8639 (U.2) connector, rather than as an M.2 drive. Like Samsung's 950 Pro drives, it accesses four 1GB/sec PCI-E 3 lanes, so it offers far more bandwidth than PCI-E 2 devices such as the Plextor M6e M.2 and Kingston Hyper X Predator M.2.

Three capacities are offered, ranging from 400GB to 1.2TB. Unfortunately, Intel could only send us a 1.2TB sample for testing, which makes direct comparison between the drives on test slightly more complicated. We don't know exactly how the lower-capacity 750 drives will perform in our test suite, but they have the same number of dies per controller channel as the 1.2TB model, so performance is likely to be similar.

The 1.2TB SSD 750 also carries a price tag that's well over double that of any other PCI-E SSD, and three times the cost of the 512GB 950 Pro. Notably, though, there aren't many PCI-E drives that offer capacities above 512GB, so

this SSD is unique in that respect.

In the absence of a 1TB 950 Pro model, if you want a PCI-E SSD with a large capacity, you'll need to dig deep into your pocket.

In terms of the hardware itself, the 20nm 2-bit MLC NAND is branded by Intel, coming in the form of 18 NAND packages. These packages pair up with the 18-channel, four-lane Intel CH29AE41AB0 PCI-E controller, which has been carried over in part from Intel's P3700 datacentre drive. The large metal casing is really a large heatsink covering the controller and some of the NAND flash, with the remaining chips placed on the underside of the card.

The 750 Series claims the top spot in many of our tests, beating even the Samsung 950 Pro. Of particular note is Iometer, where the 750 Series delivers results that blow away any other SSD on the market, with 262,787 IOPS. Compare that result to the 139,096 figure of the 950 Pro, which is already much higher than the other SSDs on test. The SATA drives languish around the 40,000 mark, so this is an amazing result.

Sequential read and write speeds are impressive too, although the 950 Pro generally has an advantage in these tests, with a notable exception being write speeds, where the Intel drive has the advantage. In the PCMark traces and BootRacer tests, however, the advantages of the 750 Series are less clear. It was the slowest drive on test for a cold boot, and plays second fiddle

to the 950 Pro in every trace. In short, this drive's massive capacity, incredible IOPS and high pricing mean it's really engineered for specific power-user workloads, rather than general desktop use.

CONCLUSION

There's a lot to like about the 750 Series. It's the only PCI-E 3 drive that comes in capacities over 1TB, and it goes like the clappers in sequential read and write tests, with very impressive IOPS results. It's also the most expensive drive on test, though, and most consumer desktop users are unlikely to see any benefits from it, particularly when you consider the comparatively slow boot time.

If you're a serious power user, then the Intel 750 is a very fast, high-capacity drive, but for everyone else, the Samsung 950 Pro offers better value for money and, with an M.2 version, is also a more practical upgrade for anyone with an X99 or Z170 motherboard.

VERDICT

An extremely fast and high-capacity drive that's great for power users, but it has slow boot times and, for general use, the Samsung 950 Pro offers much better value.

INTEL SSD 750 SERIES 1.2TB - \$1499

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
48/50	8/20	26/30	82%





Kingston HyperX Predator

Until the launch of the Samsung 950 Pro, Kingston's HyperX Predator M.2 was the fastest consumer-focused PCI-E M.2 SSD you could buy, excluding OEM models or add-in cards. With four PCI-E 2 lanes, it doesn't offer the headroom you get with newer PCI-E 3 devices, though, so it's going to be significantly slower than Samsung's 950 Pro on Intel's X99 and Z170 chipsets.

On the plus side, the Kingston HyperX Predator's performance is clearly quicker than SATA M.2 SSDs. However, the significant speed boost offered by Samsung's 950 makes the HyperX Predator look overpriced and slightly outdated.

While the Predator M.2 uses the PCI-E bus, it uses the AHCI protocol rather than NVMe. While this choice will affect performance, it does mean the drive can be used for booting from a wider range of motherboards. It can be purchased with a half-height, half-length add-in card adaptor for use in a standard PCI-E slot too, so you can use it with practically any motherboard. The drive can also be removed from this slot and inserted directly into an M.2 slot on your motherboard, if you prefer.

The HyperX Predator uses a Marvell 88SS9293 controller, coupled with Toshiba A19nm 2-bit MLC NAND flash. The only two capacities available are 240GB and 480GB, which

shrink down to 224GB and 447GB when formatted.

Despite its reliance on the last generation's top-end technology, the Predator achieves some good results. Sequential reads break the 1,400MB/sec barrier, and the 480GB model manages 1,000MB/sec writes.

However, the 240GB model sees a severe drop in write performance to just 673MB/sec, which isn't much faster than a SATA drive.

Both drives perform fairly well in other tests though. Average IOPS measured in Iometer show a gain over the SATA-based M.2 SSDs on test, although the performance boost is only around 25 per cent, and you get much better IOPS results from Samsung and Intel's new PCI-E drives. Move up to the Samsung 950 Pro, and the results are more than double those of the Predator M.2.

In the PCMark trace tests, the Predator M.2 sits close to the top, but it's again beaten by the 950 Pro. In these real-world tests, though, the difference between the drives is one or two seconds—the same gap we see from moving from SATA-based SSDs to PCI-E drives in general.

While the Kingston HyperX Predator M.2 offers reasonable performance results, they can't match Samsung's 950 Pro, which is to be expected when the latter uses PCI-E 3 and NVMe. Unfortunately, though, the HyperX Predator M.2 is

more expensive than the latter. Although the 240GB Predator M.2 is only slightly more expensive than the 256GB 950 Pro, there's a price difference of \$80 between the 480GB Predator M.2 and the 512GB 950 Pro, while the 950 Pro carries a five-year warranty, compared with only three years for the Predator M.2. It's another part of the package that doesn't quite measure up when you consider the price.

CONCLUSION

The Kingston HyperX Predator loses out due to its reliance on the older PCI-E 2 standard. It's still a fast SSD, and capable of impressive performance compared with traditional SATA-based drives, but the PCI-E 3-based 950 Pro beats it soundly in terms of both performance and value for money. It's worth considering a HyperX Predator if you have an older motherboard and want to boot from a PCI-E SSD, but for those with an X99 or Z170 board, the Samsung 950 Pro is the clear choice.

VERDICT

A decent speed boost over SATA drives, but it's far too pricey compared with the PCI-E 3 competition.

KINGSTON HYPERX PREDATOR M.2 240GB - \$299

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
35/50	8/20	19/30	62%

KINGSTON HYPERX PREDATOR AIC 480GB - \$579

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
37/50	7/20	19/30	63%





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GTX 980 Ti Xtreme Gaming
GV-N980XTREME-6GD
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- Xtreme Gaming Edition
- WINDFORCE 3X 700W Cooling System
- RGB Multi-Color Illuminated LED
- Aerospace-grade PCB Coating
- LN2 BIOS for Super Overclocking



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- RGB Multi-Color Illuminated LED
- Aerospace-grade PCB Coating



GTX 970 Xtreme Gaming
GV-N970XTREME-4GD
- 4GB GDDR5
- Xtreme Gaming Edition
- WINDFORCE 3X Cooling System
- RGB Multi-Color Illuminated LED
- Aerospace-grade PCB Coating



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Decoding M.2 and NVMe

PCI-E STORAGE SMASHES THE CURRENT SATA BOTTLENECK, BUT THERE'S A CONFUSING MESS OF STANDARDS AND TERMS, WHICH WE EXPLAIN HERE

When SATA ports first appeared on motherboards over a decade ago, it was a welcome solution to a long-standing storage nightmare with PCs. The long 40-pin IDE connector occupied a lot of space on motherboards, limited the number of storage devices to four, and relied on a master/slave configuration, with a jumper that had to be set correctly for a device to be recognised. The pins bent all too easily and were a constant cause of headaches for PC builders.

Younger readers might be grateful to have never experienced these problems, but computers and storage technology have once again moved on since the introduction of SATA. The SATA standard has gone through three revisions, each raising the performance headroom it provides, with modern SATA III devices offering 6Gb/sec of bandwidth.

This bandwidth is easily sufficient for hard disks, where even the best sequential transfer speeds of around 200MB/sec are well within the limit, but today's hot storage technology is no longer based on mechanical disk platters, but NAND flash memory that's capable of much faster performance.

Due to the limitation of the SATA bus, most 2.5in SATA SSDs have now hit a performance ceiling, with sequential transfer speeds stuck at around 550MB/sec, and they can't go any faster with the current SATA standard.

Raising this ceiling with a new, faster SATA revision would have solved this issue temporarily, only for it to return again once that extra bandwidth was used up.

All this time, SATA has coexisted with the much faster PCI-E bus, which provides more bandwidth over a number of lanes, via a more direct interface with

the CPU subsystem.

Moving storage from SATA to PCI-E means better performance, but it also creates a problem. Traditional PCI-E expansion cards can be used for storage, but only in desktop computers. A new connector was needed, with dimensions small enough for storage devices to fit into mobile computers as well as desktop PCs. That connector is called M.2. It can access both the PCI-E and SATA buses and carries both power and data. It requires no cabling, since devices plug directly into the slot.

It first appeared on PC motherboards with the Z97 chipset in 2014, but it's also present on X99 boards and the new Z170 boards that launched with Intel's Skylake

“NVMe has been specifically optimised for SSDs to exploit their inherent parallelism”

processors.

M.2, developed mainly for mobile applications as an upgrade to mSATA, was initially called 'next-generation form factor' and its scope is intended to be wider than just storage. Wireless adaptors, mobile data and Bluetooth adaptors are all supported, with each class of M.2 device denoted by the position of the notch along its pins. SSDs universally adopt the 'M' and 'B' key notch position.

M.2 SSDs come in a small stick format and, so far, no device has had any casing covering the NAND chips. They can be either single or double-sided, and not all M.2 devices are the same length. Their size is described by listing the width (usually 22) and length in millimetres;

a 2280 device is 80mm long, while a 22110 device is 110mm long. The norm for SSDs is 2280 (with some available in both 2280 and 2260 formats), but not all motherboards will accommodate a 2280 SSD, so your first job is to check what size of device your board can support.

NEW PROTOCOLS

At the same time, the low-level AHCI bus protocol, which governs how a storage device communicates with the CPU, was designed at a time when flash memory couldn't offer the performance, reliability, affordability or capacity needed for a computer's operating system installation. Its specification was based on the limitations of hard disks, which can only ever read one piece of data at a time, after a head has moved into position over the disk. There would be no need for a queue of more than 32 commands, and with single-core processors, no need for multiple queues, as only one thread could perform I/O operations at any time.

On some PCI-E SSDs, though, AHCI has also been replaced with a new bus protocol called NVMe. NVMe has been specifically optimised for SSDs to exploit the parallelism inherent in their design. Queues are now extended to 65,536 commands, and the protocol supports 65,536 queues, which works out to be far more I/O commands than AHCI can handle. There are fewer register accesses per command, leading to lower latency, and there's no thread locking, which leads to greater parallelism and improved use of today's multi-core CPUs.

Booting from an NVMe SSD, however, requires motherboard support, which is usually only present in boards based on the Z97 chipset or later, although some manufacturers may release BIOS updates enabling support on older



▲ The size of an M.2 drive is expressed with a four-digit code, starting with the 22mm height, followed by the length, so a 2280 drive (top) is 22mm high and 80mm long, while a 2260 drive (bottom) is 22mm high and 60mm long

“Younger readers might be grateful to have never experienced these problems”



boards. You should still be able to use an NVMe drive on an older board, but you won't be able to boot from it. For Windows to recognise the drive, it also needs an NVMe driver, which Microsoft provides with Windows 7 via an update or natively in Windows 8.1 and 10. Note that some manufacturers (such as Samsung) also provide their own NVMe drivers to boost speed and enable advanced features, such as firmware upgrades and secure erase.

CONFUSING TIMES

By introducing a number of separate standards at the same time, the industry

Kingston's HyperX Predator M.2 drives use the PCI-E bus, rather than SATA, but they also use the older AHCI protocol and PCI-E 2 standard

has created a confusing situation. There are now M.2 SSDs that use the PCI-E bus, which gives them additional headroom for faster transfer rates. But there are also M.2 SSDs that use the SATA 6Gbps bus, with the same performance limitations as a traditional 2.5in SATA device.

Unfortunately, the situation gets even more complicated. Older PCI-E SSDs use two PCI-E 2 lanes, which run at 4Gb/sec each for a total of 8Gb/sec of bandwidth, while newer SSDs use up to four PCI-E 3 lanes, which run at 7.87Gb/sec for a total potential bandwidth of 31.5Gb/sec – a massive increase over SATA 6Gbps. So before purchasing, make sure your M.2 slot supports the same PCI-E standards as your SSD to ensure compatibility and full speed.

Meanwhile, PCI-E SSD cards that slot

▲ To make matters even more complicated, there's also the U.2 standard, which hooks up to Intel's latest 2.5in SSDs

into a standard PCI-E slot have been around for a few years now, usually in the form of a half-height, half-length (HHHL) card. For now, this form factor coexists with M.2 devices. You can also buy M.2 add-in card adaptors, which can be useful if you have an older motherboard that doesn't have an M.2 slot, and with some motherboards, you can create a RAID array with M.2 devices using an adaptor and the on-board slot. Again, though, bear in mind that older motherboards may not be able to boot from a PCI-E NVMe add-in card.

The result of all the above is a very confusing collection of standards supported in two form factors. All the M.2 SATA drives we've seen use the AHCI protocol, but we've seen PCI-E SSDs that use AHCI too, rather than NVMe, which can also impact performance. You need to look closely at the standards supported by both your drive and your motherboard to make sure you'll get the most out of them.

To make matters even more complicated, here's one more standard to mention too, called U.2 (formerly SFF-8369), which is a new connector used on 2.5in devices. It has the same number of pins as a SATA Express connector, which it's designed to supersede.

It offers backwards compatibility with SATA SSDs and exposes four PCI-E 3 lanes for up to 31.5Gb/sec of bandwidth. So far, however, only Intel's SSD 750 can be purchased in this form factor and there are currently few motherboards that support the standard.





Kingston SSDNow M.2 240GB

The 2.5in versions of Kingston's SSDNow drives have been around for quite some time, aimed squarely at the entry-level end of the market. The drives originally launched back in 2009, when the SSD market was in a nascent stage and the majority of people's computers still relied on a mechanical hard disk for their operating system files, and an SSD was an expensive extravagance. It comes as no surprise, then, that the SSDNow M.2 bears little similarity to the older 2.5in drives, aside from its branding and the continued focus on the entry-level end of the market.

Also known as the SM2280S3, the Kingston SSDNow M.2 240GB is a double-sided 2280 M.2 SATA drive, and it uses the AHCI bus protocol rather than NVMe. Being a SATA drive, it's aimed at the opposite end of the market from the high-end Predator M.2 SSD, which has a PCI-E interface for faster speeds, but also a much higher price.

The SSDNow's 8-channel controller is called the PS3108-S8, and it comes from Taiwanese firm Phison. We've tested the 240GB flavour of the drive, but there are also 120GB and 480GB versions available. In the case of the 240GB drive, four rebranded 64GB Toshiba A19nm chips make up the storage, which totals 224GB after formatting.

Like all SSD manufacturers, Kingston

also offers its own Toolbox SSD maintenance software for download on its website. It's fairly rudimentary, but it covers all the essentials. Firmware updates, SMART monitoring and diagnostic scans are part of the show, with a secure erase function added as well.

As an entry-level SATA drive, the SSDNow M.2 goes up against the Crucial MX200, Transcend MTS800 M.2 and Samsung 850 Evo M.2, but it's outperformed by all these drives in most

"Sequential read speed is a relatively strong point, with a solid result of 531MB/sec"

of our performance tests.

While the sequential read speed is a relatively strong point, with the SSDNow M.2 achieving a solid result of 531MB/sec, it drops down fast in sequential write tests to just 355MB/sec, while other SATA M.2 devices can meet 500MB/sec. There are plenty of 2.5in SATA drives that offer faster write speeds.

Meanwhile, its result in Iometer came to just 23,512 IOPS, which is less than half the speed of even the slowest PCI-E M.2 drives on test, and slower than any

of the other SATA drives too, with a gap of at least 10,000 although, to be fair, the SSDNow clearly isn't designed for high IOPS performance.

The SSDNow M.2 also found its place in the middle of the pack in some of our PCMark real-world tests.

Even here, though, it was generally the same story as with the synthetic tests, with the SSDNow M.2 failing to deliver a single result that could be considered impressive.

The SSDNow M.2 even came in last place in the BootRacer fast boot test, with a time of 14.8 seconds, 1.5 seconds slower than Kingston's other drive on test, the Hyper X Predator AIC 480GB. In short, you can get superior performance and better value for money elsewhere.

CONCLUSION

Although the SSDNow M.2 has a deceptively low price per gigabyte, it's matched or beaten by cheaper alternatives that perform far better. The Crucial MX200 250GB is \$100 cheaper, but outperforms the SSDNow M.2 in every test, as does Samsung's SSD 850 Evo, for the same money.

The good value in terms of capacity is basically offset by a relatively uncompetitive bang per buck. If you're looking for a cheap M.2 drive, the cheaper and faster Crucial MX200 250GB is a better buy.

VERDICT

Good value in terms of capacity, but not a great performer. Crucial's MX200 M.2 is both cheaper and faster.

KINGSTON SSDNOW M.2 240GB - \$235

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
29/50	17/20	23/30	69%





Plextor M6e Black Edition 256GB

Whenever a new disruptive product is launched that seriously outclasses its competition, it instantly alters the landscape of that market. It doesn't mean alternative products cease to become a worthwhile purchase, but it often forces them to compete in terms of pricing and value for money rather than performance. Anything that costs more money than the new killer product, or even costs the same amount, without any inherent advantage, instantly becomes uncompetitive. With SSDs, that new product is Samsung's 950 Pro, so Plextor's M6e Black Edition, with its price of around \$340, is now up against some serious competition.

The 950 Pro has set a standard against which all other drives will undoubtedly be compared, thanks to the raw performance it offers, courtesy of four PCI-E 3 lanes. If Plextor had significantly dropped the price of the M6e Black Edition, it would be in with a chance, but it has its work cut out with its price of \$339 for a 256GB drive, giving it the highest cost per gigabyte on test.

The M6e ships as a PCI-E add-in

card, sporting a very attractive design, with a bright red heavy-duty heatsink on top of a black metal casing over the PCB. Remove this casing and you'll see the M6e sitting underneath it as a standard M.2 device; if you wish, this can be removed and placed into a motherboard's M.2 slot.

It comes in three capacities from 128GB to 512GB, and uses four 500MB/sec PCI-E 2 lanes. It also has the same Marvell 88SS9183 controller used in a multitude of other SSDs, including the Crucial MX200 M.2, and Toshiba 19nm Toggle NAND flash memory, which isn't quite as up to date as the advanced A19nm NAND flash used in many other drives.

With only half the available bandwidth of a PCI-E 3 device, the M6e Black Edition sits in the same boat as Kingston's HyperX Predator, and simply can't match the performance of Intel's 750 Series or Samsung's 950 Pro, which use four PCI-E 3 lanes and the NVMe protocol.

The Plextor at least offers some reasonable 32-queue-depth read and write performance, with results that sit comfortably beyond what you can achieve from a SATA SSD. However, its write speeds aren't as impressive, only overtaking Samsung's SATA-based 850 Evo by a small margin.

Notably, the 950 Pro achieves read results that are three times those of the M6e and write results that are twice as high. It's the same story in the PCMark traces, where the M6e edges slightly ahead of the SATA drives, but only barely, while the latest PCI-E 3 drives beat this

one most soundly.

Unfortunately, the M6e Black Edition's pricing is still stuck in an era when companies could charge a significant premium for PCI-E-level performance, which made sense when it was up against SATA drives, but is impossible to justify next to the Samsung 950 Pro. The 256GB M6e model on test costs only \$160 less than Samsung's 512GB 950 Pro, and it's also the only 256GB drive priced over \$300. Couple this high cost per gigabyte with middling performance, and it's clear you can get a better deal elsewhere.

CONCLUSION

The M6e would have looked impressive a year ago, when there was less PCI-E competition and SATA drives were commonplace, but you can now buy cheaper drives that offer significantly faster performance.

With the highest cost per gigabyte on test and middling performance, the M6e Black Edition is in desperate need of a price cut if it's going to compete with Samsung's latest and greatest.

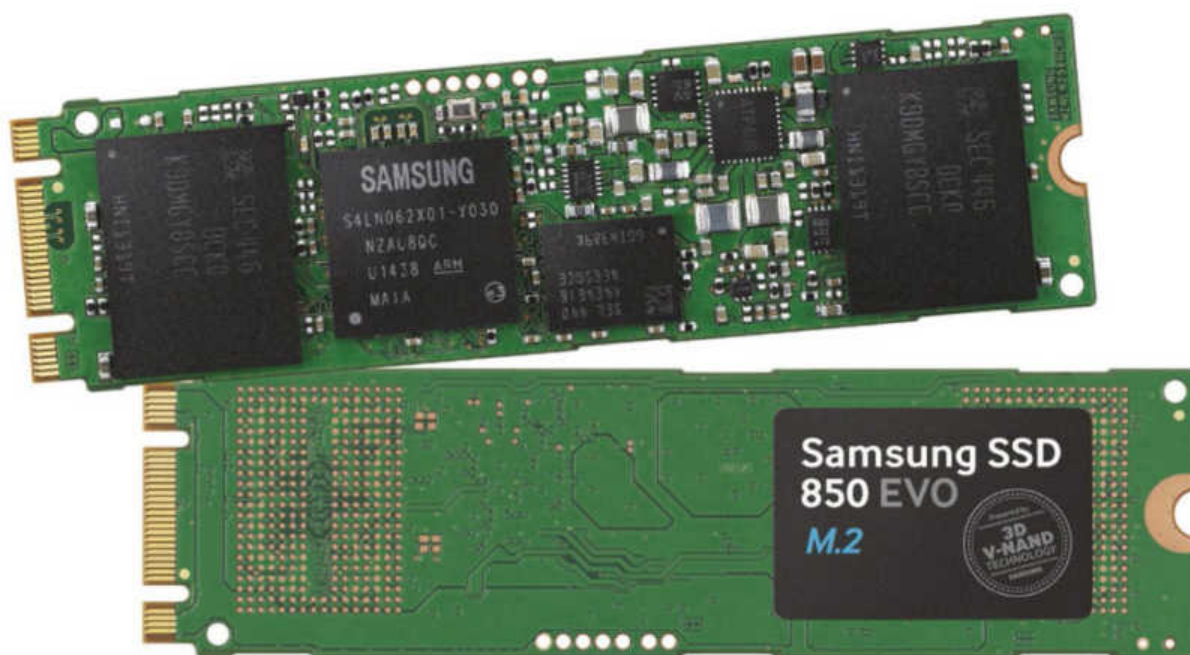
VERDICT

An improvement on SATA drives, but the extremely high cost per gigabyte and middling performance make the M6e very uncompetitive in the wake of PCI-E 3 drives.

PLEXTOR M6E BLACK EDITION 256GB - \$339

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
33/50	3/20	15/30	51%





Samsung SSD 850 Evo

The M.2 versions of Samsung's SSD 850 Evo drives lift most of the technology and features from the 2.5in 850 Evo drives and place them into a much smaller, 2280-format M.2 cards. However, these M.2 drives use the SATA bus rather than PCI-E, and use the AHCI bus protocol rather than NVMe. It's the same approach used by a few manufacturers, notably Crucial with the M.2 version of the MX200.

The M.2 850 Evo drives also share the interesting NAND flash configuration of their 2.5in counterparts. They use the same second-generation Samsung 32-layer V-NAND as the company's 850 Pro and 950 Pro drives, with all the advantages of improved longevity and performance. However, in the 850 Evo drives, the NAND is configured as TLC, or 3-bit MLC, with an SLC cache called TurboWrite.

The performance and longevity of NAND flash memory is very much affected by the number of bits each cell holds, since the more bits per cell, the more writes the cell will have to endure.

That's why the efficient SLC (1-bit per cell) cache is needed. All incoming writes go to this cache first before being flushed to the TLC portion. For most small writes, only the high-performance SLC cache will be used, and the Samsung 850 Evo will be as fast as any other drive.

The different 850 Evo M.2 capacities have varying quantities of NAND reserved as SLC cache: the 120GB and 250GB 850 Evo M.2 models have 3GB, while

the 500GB model has 6GB. Likewise, the dual-core Samsung MGX controller has carried over from the 2.5in drives, along with 512MB of LPDDR3 as memory cache.

In terms of price, the 850 Evo M.2 is only slightly more expensive than the Crucial MX200, and is the second cheapest M.2 drive on test. In terms of cost per gigabyte, it scores well, with the 500GB variant offering better value than the 250GB drive, a trend we've seen with

"The NAND is configured as TLC, or 3-bit MLC, with an SLC cache called TurboWrite"

other SSD families too.

In our benchmarks, the M.2 version of the 850 Evo delivers in both synthetic tests and the PCMark traces, with the best overall results of all the SATA-based M.2 drives. It comes out slightly ahead of Crucial's MX200 M.2, and performs significantly better than the Transcend MTS800 M.2 and Kingston SSDNow M.2 in most of the 32-queue-depth and random tests.

There are a few exceptions, though. It isn't the fastest SATA drive when it comes to sequential reads, falling behind Transcend's MTS800, and its average IOPS recorded in Iometer is lower than the result from Crucial's MX200.

Overall, however, it's a very strong

showing for a SATA drive at this price. Plus, like the 950 Pro, the 850 Evo is supported by Samsung's excellent companion toolbox software called Magician. It has a five-year warranty too.

CONCLUSION

Choosing between Crucial's MX200 or Samsung's 850 Evo is a tough decision, since both drives are similarly priced, and most of the performance results are close enough to be called a photo finish. Both drives offer excellent SATA M.2 performance at a very reasonable price.

The lower cost of the Crucial MX200 just gives it the edge in this particular league, but the Samsung Evo 850's excellent Magician software also makes it well worth considering, depending on your priorities. As with the Crucial MX200, the 500GB version of the Samsung 850 Evo also offers better value than the 250GB variant.

VERDICT

A great-value SATA M.2 drive with solid performance and great software.

SAMSUNG SSD 850 EVO 250GB - \$139

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
31/50	18/20	27/30	76%

SAMSUNG SSD 850 EVO 500GB - \$245

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
32/50	19/20	29/30	80%



Samsung SSD 950 Pro

Samsung's SSD 950 Pro breaks new ground in a few areas, being the company's first consumer M.2 drive to use four PCI-E 3 lanes for the fastest possible performance. It joins the Intel SSD 750 in being one of only two drives on test to take advantage of the 1GB/sec per channel offered by PCI-E 3 lanes. It also uses the NVMe protocol, a first for Samsung in the consumer M.2 arena, although an updated version of the enterprise-grade SM951 also supports NVMe.

The 950 Pro sports a triple-core MBX controller running at 500 MHz, with 512MB of LPDDR3 cache memory across both of the capacities on offer – 256GB and 512GB. Meanwhile, the 2-bit MLC V-NAND is the second-generation 32-layer variant, similar to the flash memory used in the 850 Pro and other Samsung drives.

Like many other M.2 drives, it comes in a 2280 single-sided format, with no room for additional die packages to increase capacity beyond 512GB, and therefore a 1TB version isn't planned until Samsung ramps up production of its higher-density, 48-layer V-NAND chips next year.

Then there's Samsung's Magician software, which offers the usual firmware updates and quick access to SMART data, but there's also a built-in benchmarking tool, secure erase and memory caching for a further performance boost, called Rapid mode. It's tied into a very polished interface, and stands out as a strong offering among competing SSD toolbox software.

The 950 Pro dominates in six of our performance tests, with the 512GB model coming out in front of the 256GB drive every time. Interestingly, there's a far bigger difference between the performance of the 256GB and 512GB capacities of 950 Pro than any other SSD family on test. In sequential 32-queue-depth writes, the difference is a significant 500MB/sec, with the 256GB capacity offering 981MB/sec, and the 512GB drive managing 1,529 MB/sec. The gap narrows a little with sequential reads, but in the Iometer tests, this same

“Sequential read and write speeds are off the scale compared the other PCI-E drives”

difference can be seen again, with the 512GB model's IOPS result being around a third quicker.

Although Intel's SSD 750 Series claims the top spot in many of the tests, both the 256GB and 512GB 950 Pro dominate any other drive of the same capacity in the majority of the remaining tests, and usually by a wide margin. The notable exceptions are BootRacer and 32-queue-depth random writes, where the 950 Pro doesn't look quite as impressive, although these results are still very good.

Its sequential read and write speeds are off the scale compared with even the other PCI-E drives. Kingston's HyperX Predator 480GB, for example, manages a still impressive 1,453MB/sec sequential

read, but the result for the 950 Pro 512GB is 50 per cent higher, with 2,331MB/sec. In every PCMark trace, both 950 Pro drives also take the top two spots, in some cases shaving a few seconds off the result of the next fastest drive.

Perhaps most importantly, though, the speeds offered by the 950 Pro are a true showcase of what can be achieved from M.2 PCI-E SSDs, when for years we've been limited by the comparatively restricted speed of the SATA bus.

CONCLUSION

The Samsung 950 Pro is unquestionably the pinnacle of M.2 PCI-E solid state storage, offering amazing performance for a very reasonable price. That said, the 512GB variant offers a significantly better deal than the 256GB drive, in terms of both speed and bang per buck. If you have an X99 or Z170 motherboard with a 2280M.2 slot, the Samsung SSD 950 Pro 512GB is the SSD to buy for it.

VERDICT

The best M.2 drive on test, but the 512GB version offers superior performance and value compared with the 256GB drive.

SAMSUNG SSD 950 PRO 256GB - \$299

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
42/50	11/20	25/30	78%

SAMSUNG SSD 950 PRO 512GB - \$499

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
44/50	12/20	29/30	85%



Transcend MTS800 M.2

Although most storage firms are moving towards higher SSD capacities, chopping even 128GB flavours from their line-ups, Transcend is clearly still keen to cater for those users who absolutely don't care about huge amounts of flash memory storage. Accordingly, the SATA-based MTS800 M.2 series is available in five capacities, including just 32GB, a capacity that could only be useful in extremely cheap laptops.

It's the 256GB and 512GB models that most interest us, though, as you then have enough room to install Windows, plenty of software and some games, with the latter occupying increasingly large capacities as games become ever more complex.

Transcend's MTS800 drives use a Silicon Motion SM2246EN SATA controller branded as a Transcend TS6500, as used in the firm's 2.5in drives. Likewise, Transcend also uses third-party flash memory – in this case, 20nm Micron 2-bit MLC. The chips are placed on both sides of the 2280 M.2 card, a break from what seems to be the norm for M.2 SSDs, with most manufacturers instead opting for single-sided placement. After overprovisioning, you're left with 238GB of formatted space with the 256GB model, and 477GB with the 512GB model.

There are a few other features worth mentioning. There's full-drive encryption and an additional circuit for data protection in the event of power loss, but the SSD Scope software has one feature sorely missing from the efforts of other manufacturers – system cloning, so you can back up your operating system from an existing hard disk onto the MTS800.

If other manufacturers offer this feature, they usually do so by bundling third-party software in the box, usually from Acronis.

As an entry-level SATA M.2 drive, the MTS800 is competing on price with the likes of the Samsung 850 Evo M.2 and Crucial MX200 M.2, but these drives are both notably cheaper than the equivalent MTS800 models.

Unfortunately, this extra premium

“There's full-drive encryption and an additional circuit for data protection”

doesn't translate into better performance, though, and in some cases, the very opposite. In a few of the synthetic tests, the MTS800 is at the bottom of the pile, or near to it, with only Kingston's SSDNow M.2 achieving consistently lower results.

Although the sequential read speeds look okay at first glance, the MTS800 drives' 32-queue-depth write speed languishes behind other drives.

Meanwhile, the mixed workloads Iometer test yielded an IOPS result of just 40,000 for both capacities on test – one of the lowest results we recorded this month. The 256GB model also comes bottom in some tests, including the Microsoft Word and Photoshop Heavy sections of PCMark 8.

There's no reason a SATA-based SSD that uses the M.2 form factor will perform any better than a 2.5in SATA drive, of

course, but you'd at least expect it to outperform decent 2.5in drives. Sadly, though, some of the MTS800 results sit well below what we'd expect from decent 2.5in drives.

The 32-queue-depth sequential write result of 318MB/sec, for example, is well behind the competition.

CONCLUSION

While it's far from a terrible drive, the Transcend MTS800 is eclipsed by competing M.2 SSDs, whether SATA-based or PCI-E, particularly Samsung's 850 Evo or Crucial's MX200. If you want to avoid the significant premium for increased PCI-E performance by opting for a SATA drive, or if you want the wide compatibility of a SATA drive, both the aforementioned Crucial and Samsung drives offer faster speeds than the Transcend MTS800, and all for less money too.

VERDICT

Tempting prices for the capacities on offer, but the competition from Samsung and Crucial eclipses the MTS800 in terms of both performance and value for money.

TRANSCEND MTS800 M.2 256GB - \$160

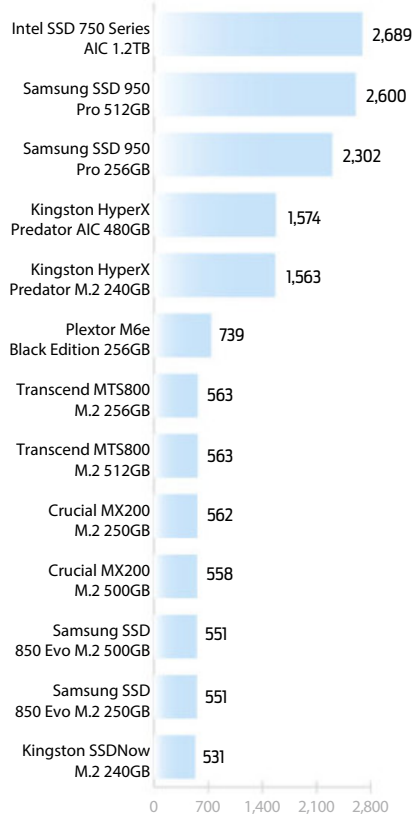
SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
30/50	17/20	24/30	71%

TRANSCEND MTS800 M.2 512GB - \$340

SPEED	\$/GB	BANG/BUCK	OVERALL SCORE
31/50	16/20	24/30	71%

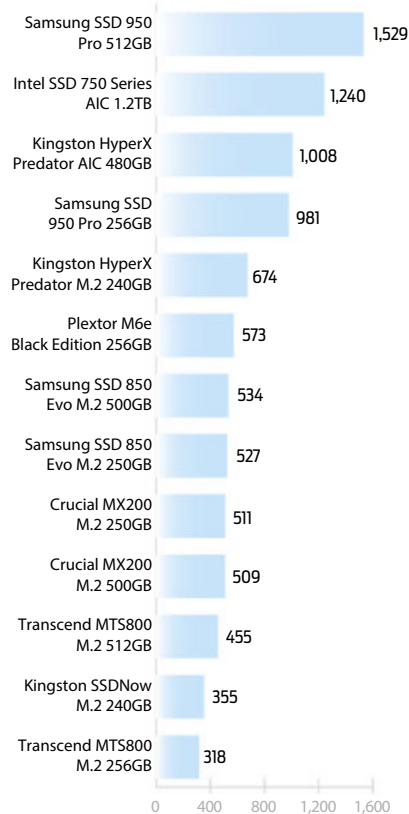
CRYSTALDISKMARK 5.0.2

Sequential read QD32 (MB/sec)



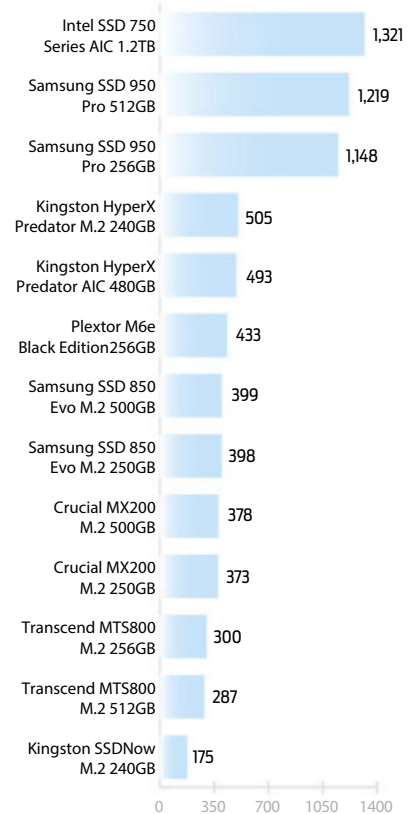
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Sequential write QD32 (MB/sec)



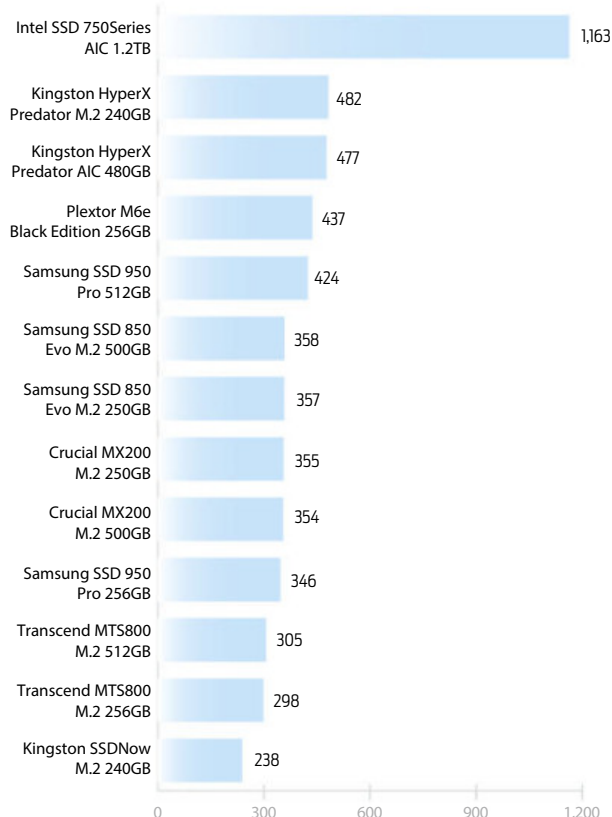
CRYSTALDISKMARK 5.0.2

Random read QD32, 4 threads (MB/sec)



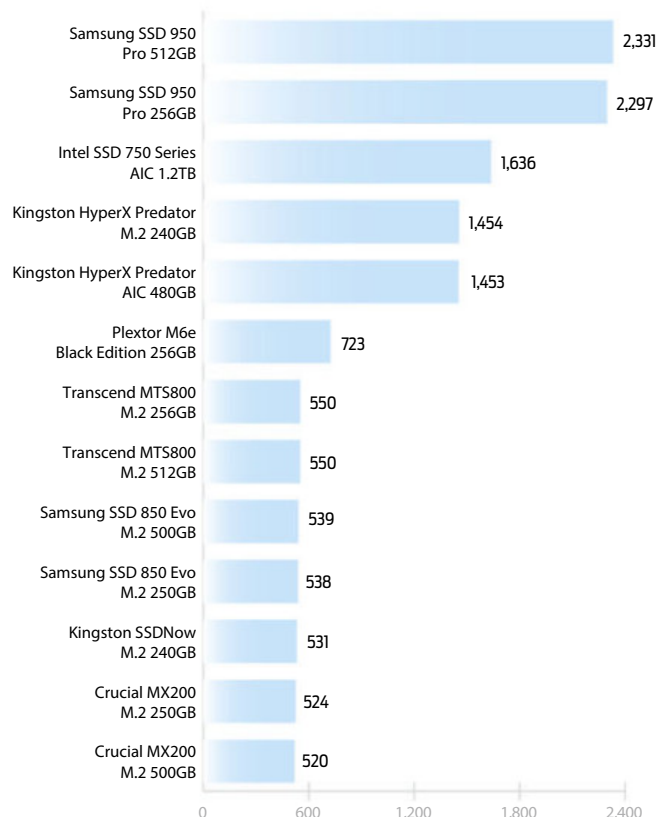
CRYSTALDISKMARK 5.0.2

Random write QD32, 4 threads (MB/sec)



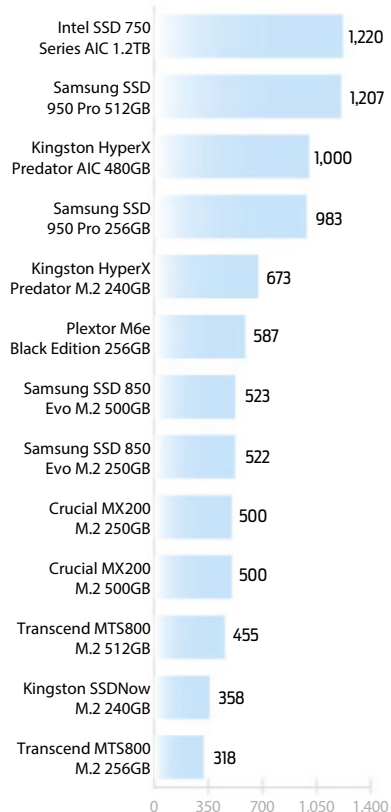
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Sequential read (MB/sec)



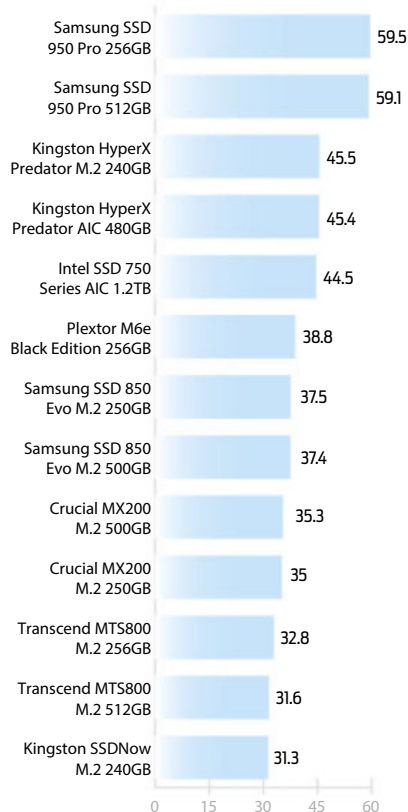
CRYSTALDISKMARK 5.0.2

Sequential write (MB/sec)



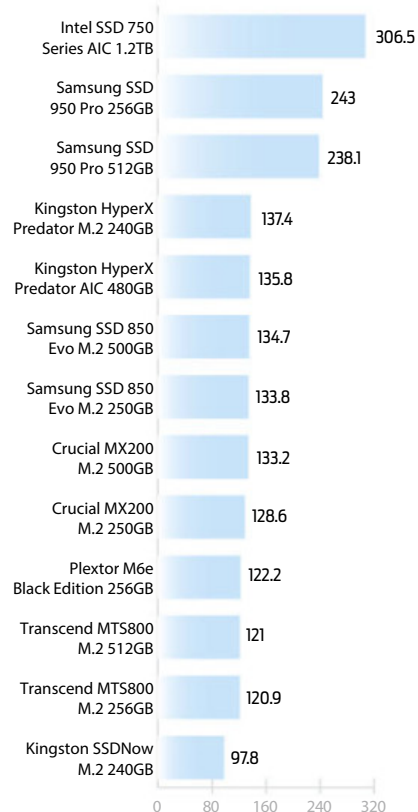
CRYSTALDISKMARK 5.0.2

Random read (MB/sec)



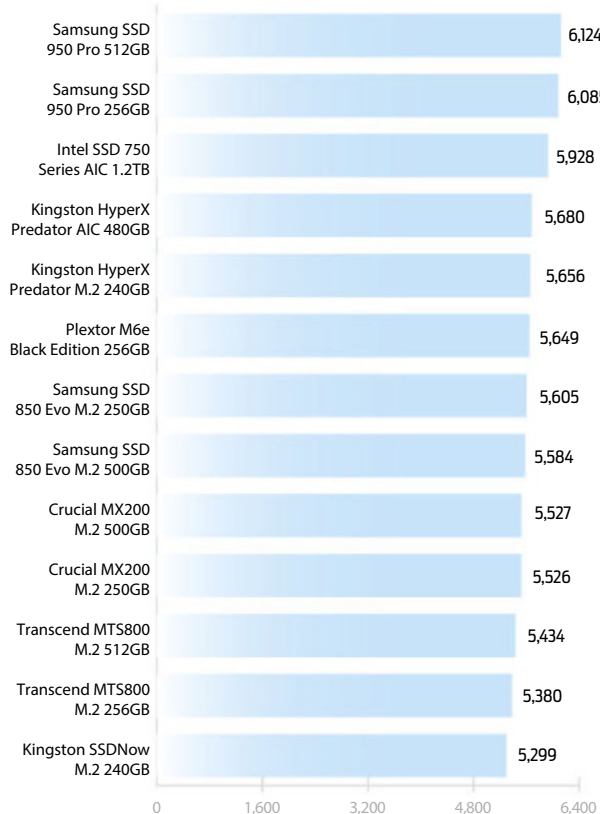
CRYSTALDISKMARK 5.0.2

Random write (MB/sec)



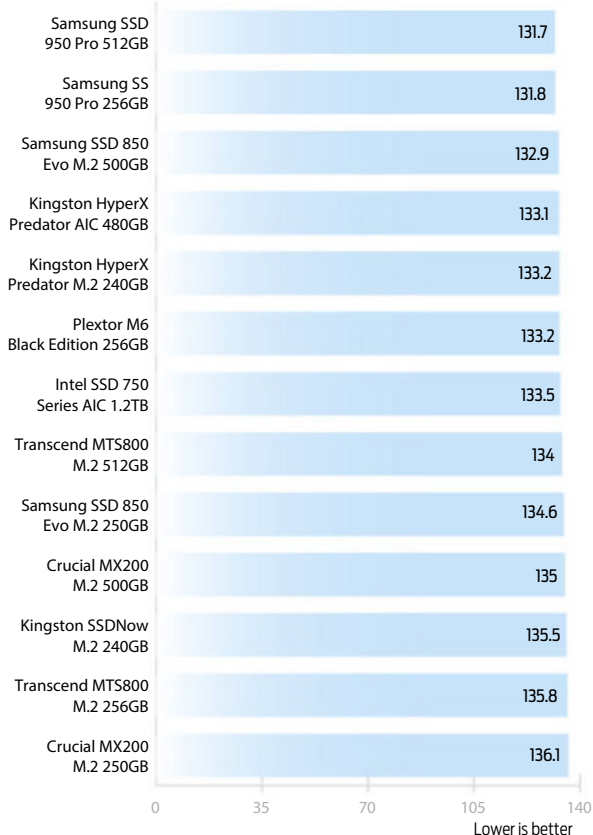
PCMARK 7

Secondary Storage score



PCMARK 8

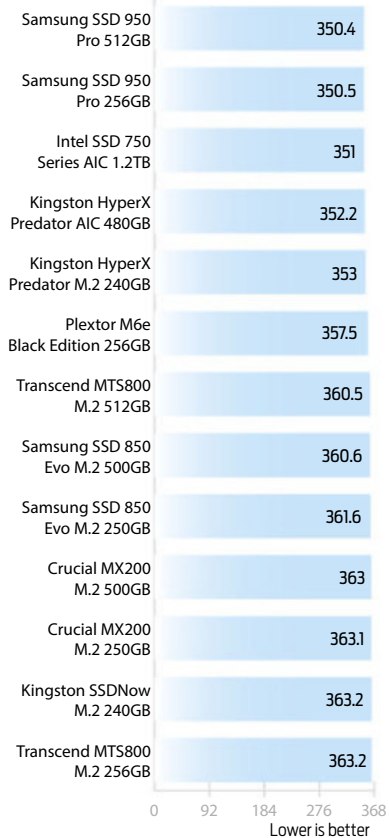
Battlefield 3 trace (seconds)



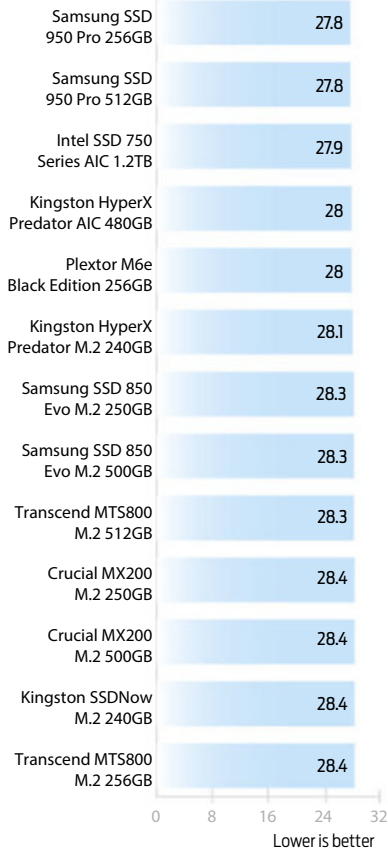
Lower is better

PCMARK 8

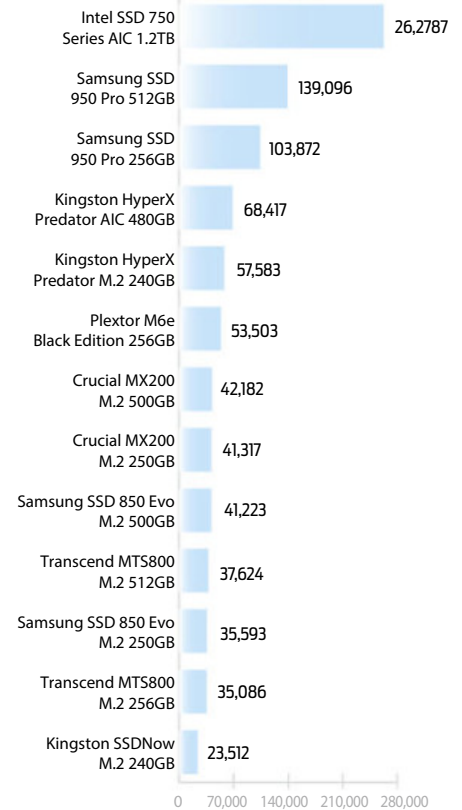
Photoshop Heavy trace (seconds)

**PCMARK 8**

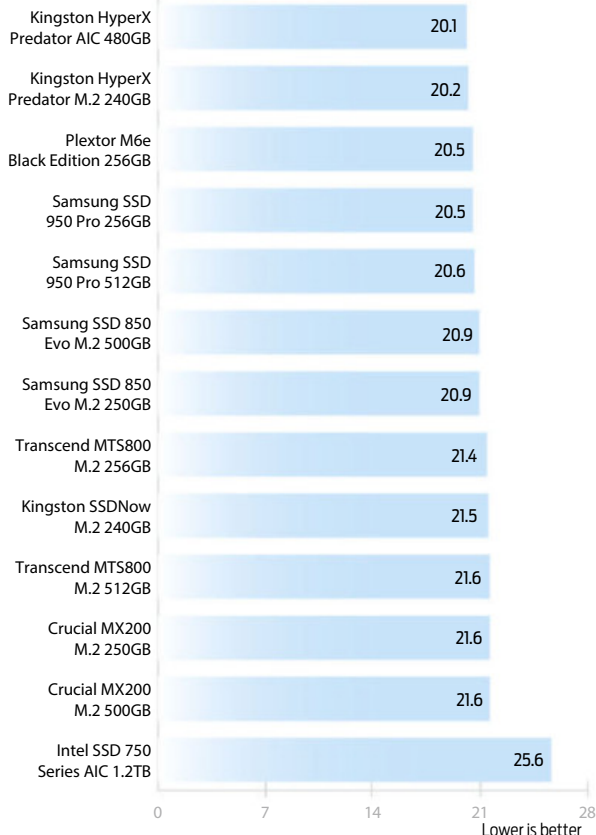
Microsoft Word trace (seconds)

**IOMETER**

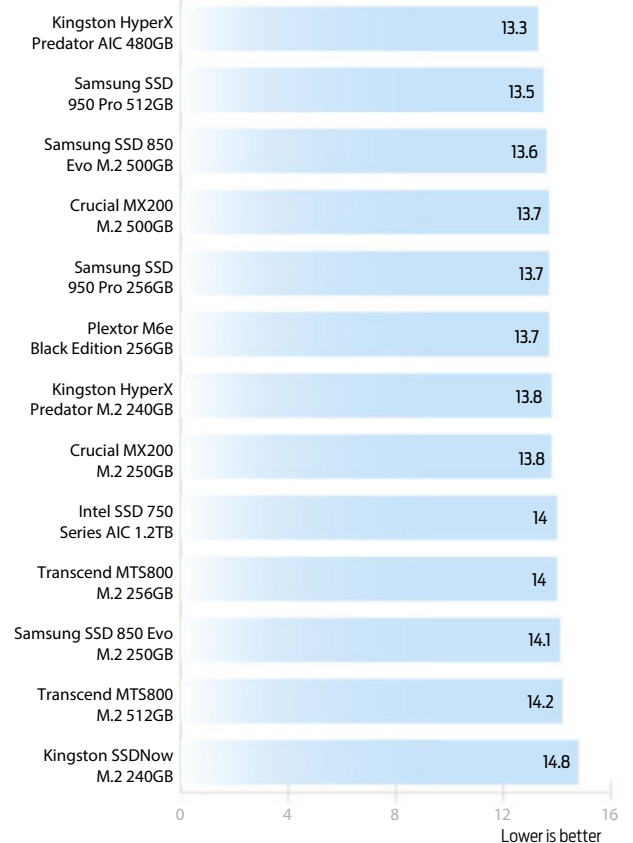
Mixed workloads average (IOPS)

**BOOTRACER**

Windows 10 64-bit cold boot (seconds)

**BOOTRACER**

Windows 10 64-bit fast startup (seconds)





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Devices like the Surface 4 Pro just wouldn't be possible without the Core M's combination of high performance and low power consumption

THE MIGHTY CORE M

Intel achieves a holy grail of CPU design with the Core M

In the quest for lighter laptops with longer battery life and innovative form factors, the processor plays an integral part as to what is physically possible. The more heat a processor generates, the more physical space required to dissipating that heat. A power hungry processor requires a larger battery, further consuming more chassis capacity. Space is at such a premium in modern portable devices, that even the size of the processor chip itself makes a difference.

Intel's latest low power processor range, dubbed Core M, enables computer manufacturers to build the sleek and portable machines we are starting to take for granted. Utilizing a cutting edge 14nm fabrication process, Intel has reduced the thermal design point (TDP) by 60%, made the chip itself 50% smaller and reduced power consumption significantly compared to the last generation of low power Core processors. With a TDP of only 4.5W, it's suitable for the tiniest of applications - from compute sticks to lightweight tablets, 2-in-1 laptop/tablets and traditional ultrabooks.

LOW POWER, FULL POWER

The Atom range of processors has taken care of Intel's low power processor needs. But Intel has managed to bring the popular and more powerful Core architecture to the low power segment, delivering with it all the benefits of the Core architecture that Atom lacks, such as a larger cache, larger maximum supported memory, superior integrated graphics, PCIe 3.0 with more lanes, Hyper Threading, vPro,

VT-x & VT-d support plus all the enterprise hardware security features available on much higher end processors. Despite the Core M's TDP is low, it is still full featured x86 CPU.

Even high end multimedia processor features such as Intel's Wireless Display for displaying monitor output on a TV or projector without cables, Wake on Voice for the ability to use your voice to unlock your computer and Quick Sync Video for fast background video encoding are part of the Core M range. Enterprise features like Intel's Secure Key random number generator, Small Business Advantage and OS Guard are built in to all Core M processors, ensuring that even enterprise users can enjoy various form factors without sacrificing the mandatory features their environment requires

INCREDIBLE MACHINES

Some of the largest computer manufacturers have released new machines taking advantage of the Core M's low power consumption and small package. Microsoft's popular Surface Pro line up now includes the Core m3 CPU in its new Surface Pro 4.

The Surface Pro 4 is really a device that can replace your desktop, laptop and tablet. Thanks to the Core m3's x86 compatibility, you get a full Windows experience in whatever mode you like, whilst still enjoying low power consumption for long battery life and great performance for the majority of computing tasks.

HP has also utilised the latest generation of Core M CPUs to create the Spectre X2, a 2-in-1 tablet and laptop. Whilst similar to the Surface Pro 4, there is a greater selection of CPUs, including the m5 and m7 - great options for when you need a bit more power than what the m3 on the Surface Pro 4 delivers, but still want similar battery life.

For a more traditional laptop experience, the HP EliteBook Folio 1020 has a choice of Core m5 processors in an Ultrabook form factor. With no moving parts and an aluminum and magnesium alloy chassis, it's designed to pass MIL-STD810G tests for not falling to pieces when dropped, shocked or subjected to intense vibration.

THE GREAT ENABLER

Intel has managed to do what many not thought possible - bring a x86 platform processor down to a TDP of 4.5W, whilst maintaining all the features and performance you expect from a Core processor. Thanks to this, we can now enjoy thin and light laptops and tablets that have oodles of battery life together with a CPU that can handle the vast majority of tasks thrown at it.





Asus GeForce GTX 980 Ti Matrix Platinum

PIPPED TO THE POST BY A WATERCOOLED BEAST

The end of the year always brings out the most extreme, not to mention expensive, tech products. Apparently consumers don't mind dropping a lot more cash into their Christmas purchases, which explains why we've seen some rather pricey graphics cards crossing our labs recently. The latest is Asus' premium take on the excellent GeForce GTX 980 Ti from Nvidia, which is our current favourite of the lot. The Matrix Platinum version of the card retails for \$200 more than the Asus Strix GTX 980 Ti, so just what do you get for that price premium?

Sadly, not a spiffy box. Compared to the stunning PowerColor Devil 13 graphics card that recently crossed our desks, which looked like it was packaged by the same folk behind Apple's delicious parcels, this premium product from Asus

comes in the usual foam-padded box. There's nothing here in the way of extras, just one rather massive graphics card and a few power plug adaptors.

When we say massive, we mean it. Measuring 29.5cm in length and 13.8cm in height, it's the card's width that is a bit of an issue. While the rear place is dual slot, the cooler extends even further, to a total width of 5.1cm. This means it'll likely knock out an extra PCIe slot compared to standard double slot cards. This is almost an extra centimetre deeper than its closest competitor, Gigabyte's water-cooled WaterForce GTX 980 Ti, though the latter does have an external radiator that must be mounted elsewhere.

The reason for this huge size is the DirectCU II cooler Asus has strapped onto this card. It's based around the usual heatpipe design, and uses twin fans with Asus' patented wing-blade design. Asus claims it's up to three times quieter than reference designs, but we didn't find this quite true. As you may have guessed from the price point, this board features a raft of overclocking qualities. A 14-phase power supply is loaded with top quality components, while an LN2 mode and memory

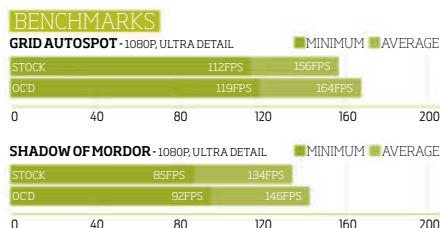
defroster is aimed at those who like the cold. We do appreciate the Safe Mode button, which instantly resets the VBIOS to default values, great if you've pushed the card too hard.

Out of the box, Asus has given this card a decent factory overclock. The default base speed of the GTX 980 Ti is 1000MHz, but Asus increases this to 1216MHz in OC mode and 1190MHz in Gaming mode. What we really care about is the Boost speed though, which is the maximum the GPU runs at whilst gaming. The default for this chip is 1075MHz, but Asus increases this to 1317MHz in OC mode, and 1291MHz in Gaming mode. This sounds impressive, until we see that Gigabyte's Waterforce GTX 980 Ti comes with the exact same factory Boost overclock, at 1317MHz, and that's in standard gaming mode, not the louder OC mode.

When it came to manual overclocking, we managed to extract a stable 1475MHz speed out of the card, while the memory peaked at 7.7GHz. That sounds impressive until we see the speed our Gigabyte WaterForce card hit – 1573MHz on the GPU, and identical memory speeds. There's also the factor of fan noise, with the watercooled Gigabyte card hitting just 41dB, while the Asus was slightly louder, at 43dB. It's still not overly loud compared to some overclocked products, with a barely audible hum once inside a case, but the Gigabyte is basically silent.

While the Asus has the benefit of not needing to mount a radiator and fan, it's unfortunately slower, louder and slightly more expensive (+\$50) than Gigabyte's competing high-end GTX 980 Ti. Both are excellent products, but we have to give the nod to Gigabyte's version.

Bennett Ring



KEY SPECS

\$1299 • www.asus.com.au

GeForce GTX 980 Ti GPU • 6GB GDDR5 onboard memory • 2 x 8-pin power plugs • 2.5 slot-wide cooler

OVERALL



Astro A40 TR Headset and Mixamp Pro

COMPETITION HEATS UP IN HEADSET LAND

Astro was one of the very first companies to release a truly high-end gaming headset in the form of the original A40 several years ago. Their immense success kicked off a gold-rush in gaming headsets, and now there are literally dozens of different models to choose from, with many made by companies that have no background in audio. This year Astro has released a refreshed version of the A40 along with a new Mixamp, but is it still the headset to beat now that it faces such stiff competition?

The biggest change to the headset itself is the support for an optional mod kit, which sells for another \$90. This allows the owner to swap out the microphone, install a leather headband, and also change the soundscape by adding closed back speaker tags with a silicon baffle. However, we're reviewing the standard kit here, and we have

to say that in their default mode the headphones are excellent. They tend to be a little bass heavy, but maintain a crisp level of detail even at the higher volumes. They're also super comfortable despite looking rather large, and the included mic does a fine job.

What makes this an interesting kit is the included MixAmp, which has been upgraded to be fully digital compared to the original analogue version. Our sample worked both with PC and Xbox, though we had major issues getting it to work on PCs with upgraded Windows 10 installations – it seems there's an audio bug in Win10 at the moment, and the only way to get these working was off a clean install of the OS. When working, the MixAmp offers a huge number of features, on top of being an excellent external audio solution that pipes out crystal clear audio, with surround support. Streamers in particular will



love the new volume controls that allow them to tailor just how loud each of their audio streams will be for their listeners, and we're sure this will become a must-have item for YouTubers and Twitchers. There's no denying how expensive this kit is, but if you're packing crappy onboard audio, there is value to be found here thanks to the MixAmp.

Bennett Ring

KEY SPECS

\$389 • www.astrogaming.com

PC plus Xbox or Playstation versions • Dolby Headphone 7.1 Surround • Game:Voice Balancing feature

OVERALL



Turtle Beach Stealth 450

OUTSTANDING VALUE

It seems that Turtle Beach has finally learnt its lesson. Over the past years we watched as the prices of their gaming headsets soared, yet delivered audio on par with more affordable solutions, and we weren't too impressed. So when this \$200 kit promised to deliver outstanding audio along with a huge range of functionality, we just had to put it to the test.

In the box are the headphones and a wireless dongle – yep, they're totally wireless, though you can run them via a 3.5mm stereo cable if you choose, which also means you can use them with a mobile device. The headset is very light, but the headband is rather tight, even on this reviewer's tiny noggin. We'd suggest bigger headed users try them on first before buying. The right ear cup includes individual volume dials for both voice and audio, along with a button that cycles between several EQ modes.

The dongle serves as an external sound device, and delivers full DTS Headphone 7.1 surround; this is our preferred format of headphone surround

compared to Dolby's competing version. Like the Astros reviewed this issue, we found the dongle wouldn't work on PCs running the Windows 10 upgrade – it required a clean install to function correctly. This appears to be Microsoft's fault though, not the headset makers.

Being wireless, they're reliant on an internal battery, which should deliver around 15 hours of battery life. That's

not a huge amount, and there's no secondary battery included, so you'll need to charge them between lengthy gaming sessions. So then, how do they sound? In two words – surprisingly good! At this price, with so many features, we expected rather average audio performance, but were very impressed with the relatively clear soundscape on offer. As usual, they're a little bass-heavy, but apparently that's what gamers want. They're not in the same league as the Astro headset, but they're also about half the price. Kudos to Turtle Beach for delivering an affordable, feature-rich wireless headset.

Bennett Ring

KEY SPECS

\$205 • www.turtlebeach.com

50mm Neodymium drivers • USB wireless dongle • 15 hour battery life

OVERALL





Just Cause 3

GOOD LOOKS WILL ONLY TAKE YOU SO FAR

Destruction is addictive. Give someone a huge sandbox to play in and the tools to blow up or tear down structures and you have the recipe for a good time. This is the basic premise of Just Cause 3. Sure, there's a rather perfunctory story about how action hero cliché Rico Rodriguez had returned to his homeland, the island of Medici to liberate it from the iron grip of stereotypically evil, impressively mustachioed dictator, General Sebastiano Di Ravello, who naturally sees his conquest of a tiny Mediterranean island as the first masterstroke towards eventual world domination, but that's just window dressing on what the game is really about. It's about experimenting with the most impressive and creative ways of blowing things up.

To that end, Just Cause 3 is a masterpiece. At any given time the player has a huge range of options at their fingertips, all primed and ready to explode, drag, pull or crash to cause a massive fireball of Rube Goldberg-esque celebration of things falling apart. There's a real thrill to causing a statue of the dictator to slap itself into rubble, affix rocket boosters to a small car and fire it into a fuel silo, jumping out at the last minute to watch the resulting chaos, or simply use Rico's unlimited supply of C4 to make things go boom. There's also a real thrill to using the movement

mechanics that have either been revamped or introduced in the third Just Cause title.

As with the previous games, Rico has a parachute that can be deployed at any time as well as a grapple that can be used to quickly traverse distances or scale objects. This time around, Rico is also equipped with a gravity defying wingsuit that allows him to soar across the landscape. All three of the movement mechanics all but seamlessly tie into each other - you can grapple a distant object and drag yourself towards it to get some serious momentum, pop your parachute to translate that momentum into lift, paragliding into the sky, and then pop your wing-suit to fly across Medici, both literally and figuratively under the radar. Or you can parachute out of a plane, wing-suit towards a road and grapple yourself into a car, taking nary a second to throw the driver out the door before you're in the driver's seat. It's a wonderful system that feels endlessly



entertaining, but unfortunately it seems as though so much time and effort was put into perfecting the movement scheme that less attention was paid to the rest of the game.

The story missions are repetitive, unsatisfying and often involve escorting AI characters or vehicles from one place to another. Not only are escort missions pretty unsatisfying on the whole, being tethered to one vehicle or character for the duration of a mission akk but cuts the player off from the parts of the game that are actually enjoyable. That said, there is a valiant attempt at integrating the missions to the gameplay mechanics in the form of unlockable challenges. Completing missions and liberating villages around Medici unlocks special challenges like races, timed wing-suit courses, grenade destruction courses and the like.

As fun as wanton destruction is, and the freedom awarded players when it comes to the manner of destruction, what can be destroyed is too limited and signposted. "Chaos" objects, those structures that need to be destroyed to liberate areas of the island are immediately obvious, not simply because of design but also because they are the only things that can be blown up in the location. Having to avoid blowing up the rustic Mediterranean building of the villages of Medici, whilst still having to destroy the Chaos objects amongst them would have added some depth to the destruction, but there is no such complexity. In Just Cause 3, if it's not evil, it doesn't explode. The result is a game of shallow spectacle.

Daniel Wilks

KEY SPECS

www.justcause.com

Genre - Sandbox Action · Developer - Avalanche Studios · Publisher - Steam · Platform - PC, PS4 and Xbox One

OVERALL



Hard West

AND NOW FOR SOMETHING DIFFERENT

The Weird West as a setting doesn't get the attention it deserves. Take the already mythologised Wild West, with its larger than life heroes and villains and tales of derring-do and layer on top of that some strange spirituality, magic, freak science and Lovecraftian horror and you have the basic setting for Hard West, the cel-shaded result of a successful Kickstarter campaign. Through a series of turn-based battles interlinked by character as well as story arcs, players shoot their way through 40-odd missions that see all manner of gunslingers, clergy, addicts, spiritualists, cannibals and more facing off against the forces of darkness that threaten the land. No matter if you're facing the mad worshippers or fallen angels, a gambler who has sold his soul to the devil or evil nuns, these enemies all have one thing in common - a serious allergy to fast moving lead.

Hard West is split up into two discrete sections, an RPG/Choose Your Own Adventure style overworld map that sees the player moving around the West visiting different towns and making simple decisions to solve problems or resolve conversations, and tight turn-based battles. For the most part the world map and the RPG-lite mechanics feel like something of an afterthought. Rather than fleshing out the world or offering interesting conundrums for players, visiting towns, solving problems and trading come across as padding more than anything else, a distraction between fights rather than an integral part of the experience. Given that playing through the battles will take around 12 hours (and a lot longer when playing on hard), such padding isn't at all necessary.



Though many of the RPG style mechanics feel mostly extraneous, there is one that fits perfectly within the mechanical framework of the game as well as the setting. As each character levels they unlock card slots to a maximum of five. These slots are used to equip cards that radically change how the characters play. Different cards allow characters to raise their stats or gain far more impressive skills, like being able to ricochet bullets around corners, eat the corpses of fallen enemies to regain health, and other, even more outlandish options. The ability to tweak character skills is great, but there is also an element of strategy that elevates the card system to near genius. Each of the cards has a suit and number on it like a regular deck, and making poker hands convey even more bonuses to the character. It's an all but perfect encapsulation of the Weird West - take something that is so rooted in Wild West mythology - in this case poker - and give it a supernatural twist.

It's obvious from the turn based battles that CreativeForge Games has learnt from the best, with solid mechanics that echo greats like XCOM and Frozen Synapse. Each turn players can move and make an action, but thanks to a

Luck meter, strategic movement is really the name of the game. Each character has a Luck meter that shows how likely they are to be hit. This plays a huge role in combat, as no matter how good the cover a character is hunkering down behind may be, Luck is the determining factor. Luck kind of works like a form of ablative armour, with the meter being reduced with each successive shot in their direction. Stay in one place for too long and enemies will be able to pick you off. Cleverly moving and shooting allows players to remain lucky and avoid damage, so long as they don't stray into a direct line of fire of course. It's a clever and fun system that makes each battle a fast paced and tense affair.

As good as the underlying mechanics are, there really isn't enough variation to make them all feel fully satisfying. Likewise, the cel-shaded presentation is beautiful, but the colour palette and forced perspective make it a little too easy to lose a character in the background and a little too difficult to judge an enemy's line of sight.

There's a lot to like about Hard West but it doesn't quite come together as a cohesive whole.

Daniel Wilks

KEY SPECS

www.gambitious.com/games/hard-west

Genre - Turn Based Strategy RPG • Developer - CreativeForge Games • Publisher - Gambitious Digital Entertainment • Platform - PC

OVERALL



**It's a
Work of Art.**
Thermaltake Core P5



Thermaltake

The A-List

ONLY THE BEST OF THE BEST MAKE IT TO PC & TECH AUTHORITY'S A-LIST

Well that didn't last long... last month we introduced the Toshiba Click 10 as the new Value laptop champ – which booted out the long-standing Asus TF103C from its grip on that category.

But this month, after reviewing the new Asus Transformer Book 2-in-1 T100HA, it's clearly better than the Click 10, so in it goes.

Anyone who ran out and bought a Toshiba Click 10 – do not fret! It's an outstanding machine, and the edge the new Asus has is clear, but slight. The full review is on page 40

WHAT WE SAID:

Toshiba's Click convertible blew us away last month, but this month the T100HA blows away the Click, being cheaper, faster and more rugged. The screen mightn't be quite as crisp, nor the battery life quite as impressive, but that's a small price to pay for such a huge drop in price.

The King is dead, long live the new King. It's time to leave the island, Apple Macbook Pro Retina, and make way for the Microsoft Surface Book. As reviewer Anthony Agius told us "I've been using the Macbook Pro Retina as my main work machine for years, and the Surface is just a far nicer machine in every way."



PC DESKTOP

ALL-IN-ONE

Apple iMac 27in with Retina 5k display

★★★★★

PRICE \$3,099

SUPPLIER www.apple.com/au

The Apple 27in iMac with Retina 5K display is great. The best all-in-one computer around, and by a furlong.

SPECIFICATIONS Quad-core 3.2GHz Intel Core i5 processor; AMD Radeon R9 M390 graphics; 8GB RAM; 1TB Fusion Drive; 27in 5120 x 2880 Retina 5K IPS display; SDXC card slot; 4 x USB 3; 2 x Thunderbolt 2; Gigabit Ethernet; 802.11ac Wi-Fi



PERIPHERALS

WIRELESS ROUTER Netgear Nighthawk X6 AC3200

★★★★★

SUPPLIER www.netgear.com.au

Designed to keep pace with high-bandwidth content consumption, it is the router King.

SPECIFICATIONS 1GHz dual core processor with 3 offload processors, 6 High performance antennas, one 2.4GHz band and two 5GHz Wi-Fi bands

DESKTOP STORAGE CalDigit T3 with Thunderbolt 2

★★★★★

SUPPLIER www.amazon.com

The T3 is an expensive RAID device, but when you factor in the drives and the capacity included, it's good value.

SPECIFICATIONS 6/9/12/15TB external hard disk with RAID; Thunderbolt and Thunderbolt 2, 135 x 241 x 116mm 4.5kg.



NAS Synology Diskstation DS415play

★★★★★

SUPPLIER www.synology.com

For most home users, the DS415play is very impressive. It's an all in one box that can literally do it all.

SPECIFICATIONS 4x SATA 3.25"/3.5" drive bays; Intel Atom Dual Core 1.6GHz CPU; 1GB DDR3 RAM; 2x USB 3.0 & 3x USB 2.0; 1x Gigabit Ethernet

ALL-IN-ONE PRINTER Canon Pixma IP 8760

★★★★★

SUPPLIER www.canon.com.au

This Canon can do it all, and at a reasonable price.

SPECIFICATIONS 9600 x 2400dpi print; 2400 x 4800ppi scan; USB 2; 802.11n WLAN; 150-sheet tray

LASER PRINTER Dell B1160w

★★★★★

SUPPLIER www.dell.com.au

The best all-rounder in our printer group test, with excellent text printing and decent costs.

SPECIFICATIONS 1800 x 600dpi resolution; USB 2; Wi-Fi; 150-sheet input trays; 331 x 215 x 178

LAPTOPS



VALUE Asus T100HA

★★★★★

PRICE \$529**SUPPLIER** www.asus.com.au

Performance that delivers everything typical day to day computing demands short of intense gaming, combined with a fantastic screen and a solid and we think, rugged design makes this the value king.

SPECIFICATIONS 10.1" IPS panel; Intel Quad-Core x5-Z8500 processor; 64GB eMMC SSD; 4GB LPDDR3 memory



PERFORMANCE Aorus X7

★★★★★

PRICE \$2,999**SUPPLIER** www.aorus.com

Super-sleek, light, outrageously powerful and with a spec-list that outclasses many high end desktop systems.

SPECIFICATIONS Q4-34GHz i7-4700HQ • 4GB/8GB DDR3L 1600, 4 slots (Max 32GB) • 17.3" Full HD 1920x1080 • NVIDIA® GTX 765M SLI GDDR5 4GB • mSATA 128GB/256GB, 2slot 2.5" HDD 500GB/750GB/1TB 5400rpm



PROFESSIONAL MICROSOFT SURFACE BOOK

★★★★★

PRICE \$2,299 – \$4,199**SUPPLIER** www.microsoft.com.au

Truly beautiful, undeniably powerful and without doubt the best professional laptop you can buy.

SPECIFICATIONS 13.5-inch 3000x2000 IPS display • Intel i5-6300U/i7-6600U CPU • 8/16GB RAM, optional Nvidia GPU • 256/512GB PCIe SSD • 802.11ac Wi-Fi • Bluetooth 4.0, 2x USB 3.0 • Mini DisplayPort



ULTRA PORTABLE Microsoft Surface 4 Pro

★★★★★

PRICE \$1,999 + \$199 (for Type Cover)**SUPPLIER** www.microsoft.com.au

A potent choice of build options, insanely great design and super-premium materials all in a clever and classy form-factor. Our pick is the i5 CPU with 8GB RAM and the 256GB SSD.

SPECIFICATIONS 12.3 inch 2736x1824 10-point touch display; 8GB RAM; 256GB PCIe SSD; Intel Core i5 CPU; USB 3.0; Mini DisplayPort, microSD; Surface Pen

HANDHELDS

SMARTPHONE Sony Xperia Z5

★★★★★

PRICE \$999**SUPPLIER**

www.sony.com.au
Similarly impressive performance and specs to the Galaxy S6 and iPhone 6s, but with the valuable benefit of dust and water resistance and a microSD slot.

SPECIFICATIONS Octa-core 2GHz Qualcomm Snapdragon 810 SoC • 3GB RAM • 32GB storage • microSD slot (up to 200GB) • 5.2in 1080 x 1920 IPS display



TABLET Samsung Galaxy Tab S2 9.7

★★★★★

PRICE \$599 (32GB, Wi-Fi)**SUPPLIER** www.samsung.com/au

It's neck and neck with the iPad Air 2, but the Galaxy Tab 2 gets it for a nicer screen, a faster CPU, microSD and being lighter.

SPECIFICATIONS 1.9GHz Octa-Core CPU • 3GB RAM • 32GB storage • 9.7in 1536 x 2048 IPS display • 7340mAh battery



EBOOK READER Kindle Paperwhite

★★★★★

PRICE \$119**SUPPLIER**

www.amazon.com
The premium Kindle goes the extra mile, with a more attractive design, lower weight, swanky page-turn buttons and better contrast.

SPECIFICATIONS 6in 1,072 x 1,448 E Ink Carta display • 2GB storage • single-band 802.11n Wi-Fi • optional 3G • 1yr RTB warranty • 117 x 91 x 169mm (WDH)



SMARTWATCH Apple Watch Sport

★★★★★

PRICE \$499**SUPPLIER**

www.apple.com/au
This is not only our pick of Apple Watches, but of the smart watch market overall at this point in time. Good features, great app support and just so nice to use.

SPECIFICATIONS 340 x 272 AMOLED • 512MB/8GB • 205mAh iOS 8.2+



SOFTWARE

SECURITY Norton Security 2015

★★★★★

SUPPLIER www.norton.com/security
Great malware protection and equally good legitimate software recognition

BACK UP Acronis True Image 2015

★★★★★

SUPPLIER www.acronis.com.au
The 2015 version adds full-system backup and dual backup and unlimited cloud storage.

OFFICE SUITE Microsoft Office 365 Home Premium

★★★★★

SUPPLIER www.microsoft.com.au
The easiest to use Office to date.



WEB DEV Adobe Dreamweaver CS6

★★★★★

SUPPLIER www.adobe.com.au
This edition makes PHP and CMS its core focus.



AUDIO Cubase 7.5

★★★★★

SUPPLIER www.steinberg.net

The addition of better filters solidifies this program's continued place on the A-List.



VIDEO Sony Vegas Movie Studio HD Platinum 11

★★★★★

SUPPLIER www.sony.com.au
May not have the bells and whistles of other consumer editing packages, but its tools are efficient.



PHOTO Adobe Photoshop Lightroom 6

★★★★★

SUPPLIER www.adobe.com.au
Lightroom 6 doesn't add up to a revolutionary update, but it improves on what was already an exceptional piece of software.



The Kitlog

DREAM BUILDS WITH REAL GEAR

For the first time in several issues we have no changes! We did debate switching around the MSI 980Ti Gaming 6G for the Asus GTX 980Ti Matrix Platinum, but concluded that even with its extreme water cooling and massive factory overclocks, the new Asus is in the same boat as the MSI 980Ti Lightning which we reviewed recently. In short, it's a massively powerful card, and should you choose to purchase one you surely won't be disappointed, but at a couple of hundred dollars cheaper the MSI Gaming 6G is already an immensely powerful card, and better value overall.

THE GAME BOX

CPU



INTEL CORE I5 6600K

PRICE \$359

Gaming generally doesn't make use of hyper-threading which makes this the CPU of choice for this box.

MOTHERBOARD

ASUS Z170 PRO GAMING

PRICE \$279

Our Skylake Value Award winner, it packs in a complete set of features yet is priced reasonably. Good audio also means we don't need a sound card.



MEMORY



8GB OF DDR4

PRICE \$120

The speed and brand makes so little difference to performance we can't recommend one over another.

VIDEOCARD

NVIDIA GTX 970

PRICE \$500

Quiet, sips power, but when the performance is needed this blazer eats up the frames.



THE PERFECT PC

CPU



INTEL CORE I7 6700K

PRICE \$525

Intel's top-shelf unlocked i7 CPU.

MOTHERBOARD

GIGABYTE GA-I70X GAMING G1

PRICE \$800

The most complete 100-series motherboard you can buy today.



MEMORY



32GB OF DDR4

PRICE \$430

For a general-purpose build 16GB is all you need, but go big if you know you need more.

VIDEOCARD

MSI GTX 980TI GAMING 6G

PRICE \$1089

Faster than a Titan X and several hundred dollars cheaper, this is the 980TI to have right now.



TOTAL: \$2851 RIG ONLY: \$1967

COOLER



COOLERMASTER NEPTON 140XL

PRICE \$120

Easy to install AIO CPU cooling, relative quiet and performance to rival twin-radiator units.

CASE



BITFENIX RONIN

PRICE \$99

BitFenix continues to deliver great budget cases that look terrific and are easy to build in.

SYSTEMDRIVES

SAMSUNG 850 PRO 512GB

PRICE \$365

This SSD offers greatly improved durability. Supplement it with a hard drive of your choice if needed.



KEYBOARD

CORSAIR K70

PRICE \$170

The glorious perfection of mechanical keys with well thought-out gamer design.



DISPLAY



LG IPS277L

PRICE \$499

27 inches of IPS glory. The resolution isn't perfect, but the price is. The thin bezel makes this a very attractive screen.

MOUSE



CM STORM REAPER

PRICE \$85

Perfect feel, though a little large and heavy for some tastes, a lighter alternative is the Turtle Beach Grip 300 (\$54)

AUDIO

HYPERX CLOUD II

PRICE \$149

The HyperX Cloud II provide excellent sound quality and not just for the price range.



CORSAIR VOID

PRICE \$130

The USB 7.1 model is the best balance between price and performance.

POWER SUPPLY

COOLER MASTER G750M

PRICE \$125

Outstanding value for money, it's powerful enough for even performance PCs packing twin GPUs.



TOTAL: \$8127 RIG ONLY: \$6820

COOLER



CORSAIR H100i GTX WATER COOLER

PRICE \$179

Excellent cooling that is easy to install with advanced monitoring.

CASE



ANTEC S10

PRICE \$699

If you absolutely must have what is very nearly the best case we've seen, this is the one.

SSDS

INTEL 750 1.2TB SSD

PRICE \$1499

Leaves SATA SSDs in the dust.



2 X SAMSUNG 950 PRO 512GB PCIE/M.2 SSD

PRICE \$529 each. Intel's equal, and in a smaller M.2 form-factor.

KEYBOARD

CORSAIR VENGEANCE K95

PRICE \$189

The perfect keyboard. Lovely Cherry Red mechanical switches, a slick and attractive aluminium body and customisable backlighting make this The One.



HDDS

ANY HDD

PRICE \$100 (2TB)

Supplement the SSD with cheap HDD storage.



MOUSE



CM STORM REAPER

PRICE \$85

Very solid and feels fantastic under the hand with sweet on-screen movement.

AUDIO



PHILIPS BDM4065UC 4K 40"

PRICE \$1033

It's huge, remarkable value and having one in front of you is PC paradise.

POWER SUPPLY

CORSAIR HX1000i

PRICE \$299

Corsair's mighty HX1000i pumps out extremely reliable power, even when under full loads.



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- Complimentary dinner for two at Komune Resort & Beach Club restaurant

Set on the lush and unspoilt East Coast of Bali, **Hotel Komune Resort and Beach Club** is blessed with a hypnotising view of the world famous Keramas surf break. The resort is conveniently only 50 minutes away from Ngurah Rai International Airport. With its pristine volcanic beach, this 4 star beachfront Bali resort offers a wonderful experience of spending leisure time in a natural luxury hotel. Sumptuously appointed accommodation with artistic furniture, this unique Bali resort articulates the identity of the Island of the Gods.

In 2015 Hotel Komune launched its new Health Hub facility at the Bali resort after recognising demand from guests for further health and wellness experiences. The Health Hub features a yoga centre, 25m training pool, functional training centre, day spa, health café and fitness centre.

For more information, visit www.komuneresorts.com/keramasbali



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TURN A \$100 WEBCAM INTO A SECURITY CAMERA

Inexpensive webcams are an excellent way to add security to your home and office. **Nik Rawlinson** shows how – and explains the pitfalls



It's not long since setting up a video surveillance system involved a lot of time, money and mess. Time because it was complicated; money because you had to invest in some hefty kit; and mess because it invariably required drilling, cable-feeding and housing a recording device.

Not any more. Modern webcams, which are cheap, flexible and easy to install, do just as good a job. They often boast high resolutions, night-vision and – a real bonus – remote control using simply a browser and a broadband connection.

In this hands-on walkthrough, we're going to explain how to set up your own office or home security system using a cheap, easily configured internet protocol (IP) webcam. We've specified an IP camera, rather than one that connects to a PC over USB, because IP webcams connect directly to a router and so can stream to the web when your computer is turned off.

CANDID CAMERA

By their nature, webcams can reveal a lot about you – and anyone else they can see. Before you go any further, you need to secure your camera with a robust password.

Many manufacturers ship their webcams with default login credentials, which are often the same on all models. Unless you change them, anyone who can determine what kind of camera you're using will also be able to access your live stream, since the passwords are only a Google search away.

Insecam is a site that streams live

✓ The Insecam site streams thousands of webcam videos, like of this office in Moscow...



“Cameras should not be deployed as a quick fix, but a proportionate response to a pressing problem”

footage from insecure IP cameras. Is the site doing anything wrong? Maybe not – it isn't hacking in to anyone's camera, after all. Still, to avoid having your stream appear in its list of links, change the password through the camera's built-in config pages.

At one point, Insecam was streaming more than 73,000 cameras, plus details of the manufacturer, the model and the approximate location. This represented a major breach of privacy and data protection rights that was extremely concerning for us and many other global data protection authorities.

✓ ...or a children's park in Seoul, Korea, where it appears to be school-hours



IS THERE A BETTER SOLUTION?

It's important to think carefully whether a camera is the best solution to a perceived problem. For example, might better security lighting achieve much the same result? Also, be careful where you position any equipment: ensure you record only relevant footage and minimise any potential overspill into other, private areas.

Surveillance cameras should not be deployed as a quick fix, but a proportionate response to a real and pressing problem. Before putting in surveillance cameras you need to understand the problem and whether that is an effective and proportionate solution. Failure to do proper privacy impact assessments in advance has been a common theme in enforcement cases.

As long as you're happy with this, the following 12 steps are all you need to know to set up your own security system at minimal cost. The process should take around two hours to complete.

✓ You can even check out what's happening in a barbershop in Japan



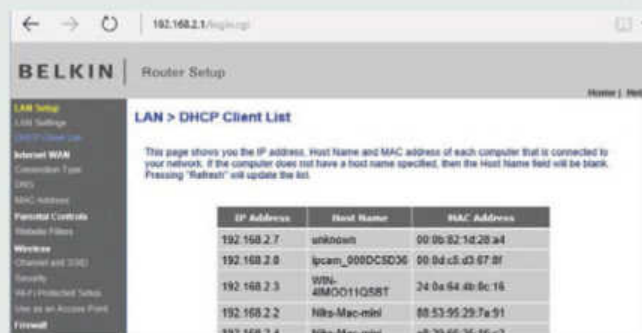


SETTING UP A WEBCAM SURVEILLANCE SYSTEM IN 12 STEPS

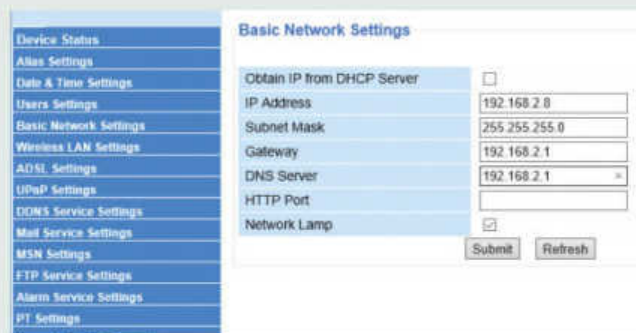
1 We're using a Foscam FI8918W wireless webcam with night vision because it's relatively cheap (\$100 on Amazon) and can be controlled through the browser. This means you can pan and tilt to get a better look at its surroundings from wherever you happen to be. A lot of rivals devices are similar. The key is to look for a camera that connects directly to your network by Wi-Fi or Ethernet and has a built-in web server.



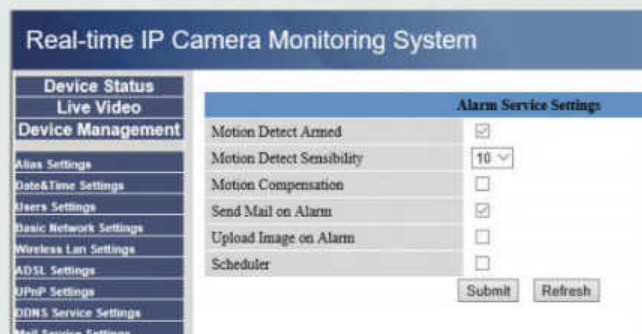
2 Position the camera, balancing good coverage with respect for others' privacy. Avoid any bright lights between the camera and the target area. Keep it out of the way of pets or they will activate motion detection. Most cameras ship with a 0.75in bracket: don't worry if the only practical location for mounting this is under a worktop or shelf, since there's normally a "flip" option to re-orient the image.



3 Open your router control panel by typing its address into a browser (find it by typing "ipconfig" at the Windows command prompt and using the address beside "Default Gateway"). Click through to the list of devices attached to the router to find the camera's address. Type this into your browser to open the camera's web server. Change the username and password if necessary, then move on to the camera's network settings.



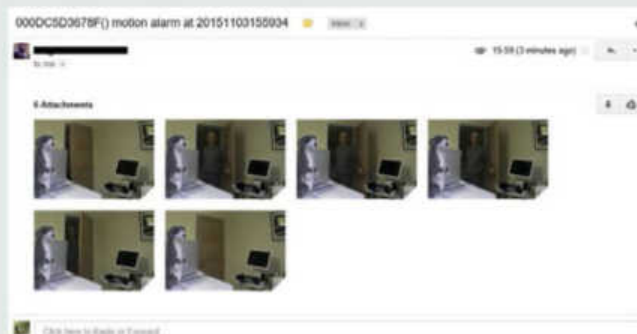
4 To access the camera remotely, we need to fix its address on the local network. This way, we can route requests to it directly from our broadband connection. Uncheck the camera's DHCP option and assign it an address that's not in use on your network. Enter the "Default Gateway" data from ipconfig in the gateway and DNS server boxes, plus the subnet mask (also from ipconfig) in the appropriate field.



5 Reboot the camera, then log in using its new IP address. In the config pages, look for an alarm service (possibly called "Motion Detect"). Check the option to activate motion detection, then decide whether you want it to email an image of the detected movement, upload it using FTP or both. We want to receive an email, so check that box, click "Submit to confirm", wait for the camera to reboot and return to the config pages.



6 Open the mail service settings and tell the camera who should receive the images and how it should send them. We're going to send them to one person, so we've entered their address in the appropriate box, adding the sending address. We then need to add the SMTP server, SMTP port, username, password and security options in the boxes at the foot of the page to match the "from" address.



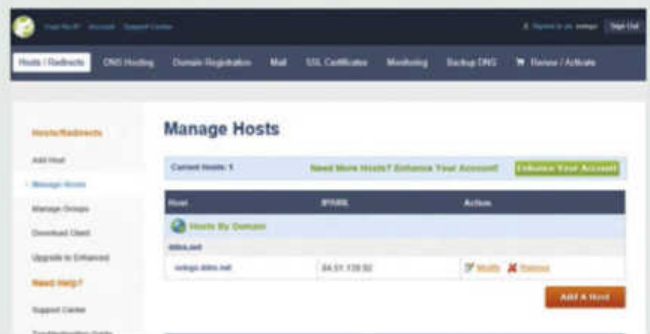
7 The easiest way to test the motion detection is to walk in front of the camera, then refresh your email inbox. If an email doesn't appear and you're sure the camera's settings are correct, check your spam bin: that's where ours ended up the first time we tested the system. If there's nothing there, return to "Alarm service Settings" and adjust the "Motion Detect Sensitivity" option so that it triggers with less movement.



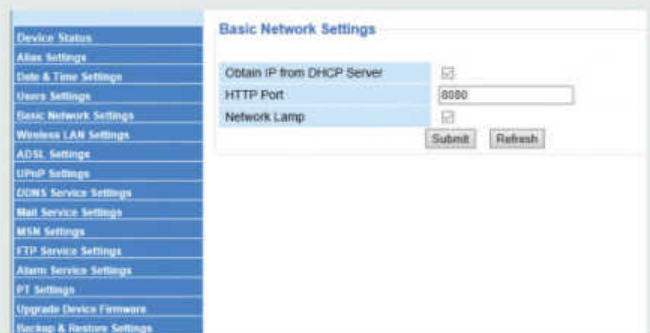
9 We need to add this host name and our No-IP credentials to the camera configuration, so it can log in to the account and update the system when it detects a change to our router's IP address. Return to the webcam configuration pages, open the DDNS settings and select the service you're using. Enter the username, password and host you specified during setup, then save the changes and wait for the camera to reboot.



11 The camera now knows what to do when it receives an incoming connection, but we haven't built the bridge between it and the router. We'll do this by logging in to the router again, opening virtual servers (sometimes called port forwarding) and adding an entry to direct incoming connections on port 8080 to our camera's IP address. We have also specified 8080 for the private port to match the settings on the camera.



8 We need to set up full remote access so we can view the live video online without having to wait for the motion-detect system to trigger. We'll use a dynamic DNS service that our camera can update every time it detects its broadband IP address changing. Our camera supports No-IP, so we've signed up for a free account at noip.com and picked the subdomain "ovingo.ddns.net" (using your own domain is chargeable).



10 We're also running a server on our network, which we want to access through the regular HTTP port (80). To avoid confusion or any tricky internal rerouting, we'll adjust the camera's web server so it's accessible through port 8080. To set this up, we return to the "Basic Network Settings" and enter 8080 in the HTTP port box, but leave all of the other settings, as entered in step 4, as they are.



12 Now that the router knows where to send requests, when we type ovingo.ddns.net into a web browser it will update to the last known IP address the webcam supplied to the No-IP service, with "8080" tacked on to the end. The router will spot this, reroute the request through the internal network to the camera and let you – or anyone with the password – log in and control it remotely.



my DIGITAL CAM



There are mobile workers and then there are truly mobile workers. Sick of sitting behind my desk, day in day out, this summer I decided that I wouldn't drive to the office every day, but actually drive my office, giving me the freedom to work from almost anywhere I pleased. Ladies and gentlemen, may I present the digital camper van.

Everything starts somewhere, and with a project such as this, the base vehicle determines pretty much everything else. I opted for a 15-year-old, grey import Japanese MPV, the brilliantly named Mazda Bongo. As a starting point, it ticks all the right boxes, especially if you have the model with the electric raising roof for extra headroom. With only a tight budget to work with, however, I opted for the cheaper "tin-top" version, which is perfect for the kind of day trips or occasional weekend away that my usage requires.

My Bongo came with eight seats that



◀ The table folds out from the Bongo's kitchen unit



➤ When my phone is in Wi-Fi hotspot mode, I connect via a VPN for an extra layer of mobile security

A PEK VAN

Davey Winder reveals how he converted a Mazda camper van into a mobile office, complete with laptop chargers and high-speed internet

can fold flat to form a huge double bed, and a sliding door for access to the rear. I immediately reversed the middle set of seats to give me two rows facing each other and a roomier interior for relaxation or checking email. It didn't, however, provide enough space for comfortable laptop use and was crying out for a table.

A simple folding table popping out from the side of the van would do at a pinch, but it wouldn't provide the kind of dual-functionality I required. Instead, I removed the rearmost row of seats and replaced them with a kitchen unit. This comprises a gas-powered hob and a sink with pumped water from tanks below, meaning I could make coffee and rustle up vegan sausage sandwiches as required. Better yet, the addition of two wooden benches over the rear wheel arches (and attached to the kitchen unit) made for a better place to sit and type. The table, or desk, folds out from the kitchen unit between the

benches. As well as providing eating and working space, the table and benches combine with the remaining seats folded flat to form the bed. Much cheaper than hotels when overnight accommodation is required.

The Bongo already has blinds fitted for the side windows in the rear, and I've added some simple curtains to the rear window and to isolate the back from the cab. This makes it private overnight and keeps the harsh sun out during the day. I take a set of "thermal blinds", which sucker-cup onto the inside of the front and back windows, with me for those colder nights away.

POWERING UP

Most camper van conversions – the Bongo is no exception – end up with a mains electric hook-up fitted to provide 240v power to ordinary plug sockets. These obviously only work when actually hooked

up via a long cable attached to a socket in your house or at a campsite – not ideal for getting a bit of work done when you find yourself parked up in the middle of nowhere. That's where the addition of a leisure battery comes in. Unlike the regular starter battery, which provides a big burst of power to turn your engine over, the leisure battery provides a steady current. I've installed a split-charge relay system, which means that both the starter battery and the leisure battery are charged by the alternator as I drive along, meaning I always have power waiting for me when I park. That power is then used for the lights in the back of the van, the pump that delivers water from the storage container to the sink taps, the electric cool box that keeps my lunch fresh, and the combination of 12v and USB power sockets by my table.

These are rated at 1A and 2.1A respectively, which is the same kind of power you find on most home twin



- ▲ There are 12V and USB power sockets by my table, with 240V plugs available when hooked up on-site
- The Bongo is still a work in progress, with plans to add solar panels and convert the engine to LPG

USB chargers. This means I can plug my phone and my tablet in when I stop and be sure they are always charged. That's essential when your tablet or phone is also your internet hotspot (more on that in a moment). The same unit gives me a standard cigarette-lighter-style 12v socket, which I use to top up the laptop.

How so, given that no laptop runs on a 12v input? Rather than take the more expensive and somewhat overkill option of installing a power inverter to convert the 12v DC feed into a 240v AC one, I opted for an in-car laptop adapter that costs a fraction of the amount. For \$50, I have an adapter that just plugs into my accessory socket and lets me dial up the output voltage I require. With the help of the bundled charging tips, this means I can happily charge my 19v work laptop when necessary. As a bonus, it's a totally removable unit, so can be used in other vehicles and as an aeroplane power adapter. Of course, the sensible course of action is to use as little external power as possible, which is where my Chromebook comes in to the picture.

BACK-OF-THE-VAN BROADBAND

I've opted for an Asus Flip C100P, which, as the name suggests, is a fully convertible Chromebook that switches from a laptop to a tablet in one smooth action. Not only does this mean I'm saving valuable space when on the road, since I don't need to carry two devices, but the ridiculous battery life (I can easily get a full eight hours of email, online research and word processing out of a single charge) does away with the need to worry about power sources on

- A \$50 in-car laptop adaptor lets me dial up the voltage I require and charge my 19V battery when necessary



the move. It's a quick-charging device as well, getting me from 10% to three-quarters full in just an hour or so. That said, my to-do list has a solar panel installation on it to enable the sun to top up my leisure battery while I'm parked up (rather than requiring the engine to be running for the split-charge system to work), providing an eco-friendly source of power for my laptop.

That brings me onto connectivity, an essential for the Chromebook. There are all sorts of commercial internet solutions available for motor homes, most far beyond low-budget territory. I don't want to mount a satellite dish or aerial on the roof – the Bongo is tall enough without adding stuff to exclude me from even more car parks around the country. Instead, I made use of kit I already had.

My primary means of connecting to the internet is my phone, which is currently a Moto G running Android. I can run this in Wi-Fi hotspot mode when required. This functionality is easy to set up, complete with WPA2-PSK-protected access. I connect to it via a VPN for another layer of out-and-about security. As well as being secure, stable and simple to configure, this kind of mobile broadband setup is incredibly economical. I use a SIM that gives me 8GB of tethered data a month on top of my "normal" usage, at 4G speeds where available, for a little over \$40 per month.

Unless you're working in your vehicle every day, or have an uncontrollable video-streaming habit, that is more than adequate. What's more, since I can use my existing phone, there's no need to invest in additional hardware

or contracts. It's the perfect mobile broadband working

solution for an office on wheels – unless you're parked somewhere where there's no Three signal, that is.

With this in mind, I invested in a PAYG fallback solution on a different network in the shape of an EE Buzzard in-car Wi-Fi unit. Rather than buying the latest hardware, I got a great deal on the older "version one" kit, which I picked up for less than \$40, including \$20 of data. This acts as a 4G USB Wi-Fi hub that plugs into the cigarette lighter socket. The 12v adapter comes off, too, leaving you with a standard USB-powered MiFi stick, which means you can use it in or out of the car. If the Three network lets me down, I simply plug the Buzzard into one of my kitchen unit USB sockets to use the fallback connection.

THE ROAD AHEAD

The Bongo, which I have named Jean-Claude, because it's a fine damn van, remains a work in progress. As I mentioned, there are already plans to add solar panels on the roof as an off-grid power source for the leisure battery and my assorted kit.

My to-do list also includes a conversion of the "eco engine" to run off liquid petroleum gas (LPG), which is not only half the price of petrol, but produces minimal emissions. That just leaves in-van entertainment to sort out in the form of an Android Auto system. With suitable touchscreen head units now available for less than \$1,000, better integration with phones and increasingly usable apps support, this has already moved up my list a notch or three. In the meantime, my mobile office is up and running. Having said that, I might just head back inside, at least until it gets a bit cooler again... ●



Need a hand tweaking, cooling,
overclocking, benchmarking,
optimising and game-making?



The **PC PowerPlay**
Technical Handbook
has you covered.

ON SALE JANUARY 21



BUILDING BLOCKS: WHY TECH IS GOING MODULAR

Modular designs could let us personalise wearables and extend the lifespans of our smartphones, but challenges lie ahead. **Nicole Kobie** reports

Your smartwatch vibrates; it's running out of battery. Rather than dashing to the wall for a power socket, imagine simply popping out a link in your wrist strap and simply slipping in a new battery.

This is the promise of modular devices: drop in a new camera, a refreshed battery or extra sensors to upgrade or personalise your smartphone, smartwatch or even desktop PC.

We're a far cry from this scenario today. Most manufacturers glue in smartphone batteries, and SD slots are rare enough to be notable in reviews, so the few modifications we could make are usually off the table.

This might be set to change. Google is working on Project Ara, a modular phone that allows you to slot new components into the "endoskeleton" of the base device. The Fairphone 2 uses a similar design ethos, allowing users to replace the battery and other components.

It's not only smartphones. A modular smartwatch, Blocks, has raised US\$1.4 million on Kickstarter, while Acer unveiled the Revo Build, a PC with Lego-like stackable components designed to make upgrading simple, at IFA in September.

What has spurred this swing to modular hardware? And does it have any prospect of long-term success?

BUILDING BLOCKS

Serge Didenko and his co-founder Alireza Tahmasebzadeh have been working on the Blocks smartwatch for three years. The inspiration for the modular design was a disagreement over which features to include in their device. "Neither of us could agree on which features were more important," Didenko told PC & Tech Authority. "I wanted all the health and fitness features and my co-founder wanted gesture control and more business features. We each wanted our own personal experiences from a wearable."

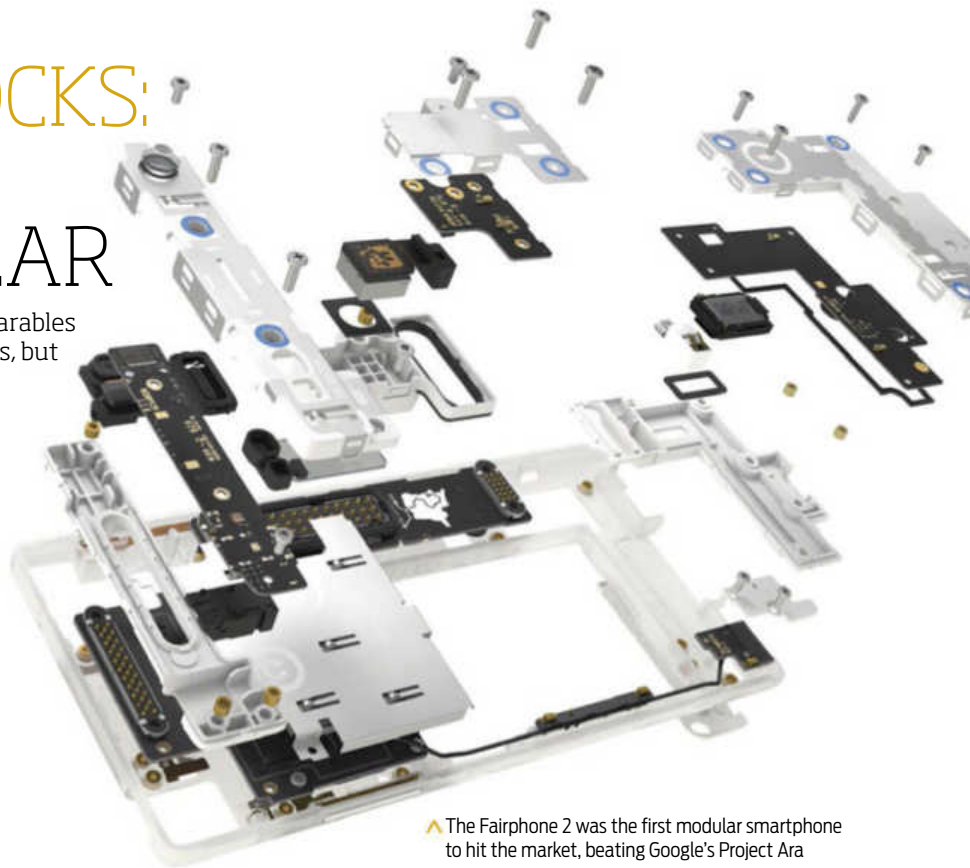
This was also true of the potential customers they polled. "They're not

all the same," said Didenko. Athletes may desire a heart-rate monitor, but that may not leave room – physically, financially or in terms of battery life – for other features, such as gaming gesture controls, GPS, a fingerprint scanner, NFC payments or dual-SIM support. "The number of sensors available is really large, but bringing it into a single

"If your Blocks smartwatch is missing a feature you can't live without, there's no need to shop for a new watch – you can add another module"

device would be very hard," he said. "Big tech companies today are having to compromise on the features they include in a smartwatch, because there's only so many you can fit into a single watch."

The Blocks device is a complete smartwatch, featuring an activity tracker, 1.5 days of battery life, voice controls and haptic feedback, and users can add extra sensors to the strap for \$30 each. "Why should we compromise and not include it when some people will love it?" said Didenko.



▲ The Fairphone 2 was the first modular smartphone to hit the market, beating Google's Project Ara

Acer believes modular designs could bring mobility to desktop PCs, letting you carry around your hard drive to play music, your power bank to charge other devices or your projector for presentations, according to Acer spokesperson Manuel Linnig. This offers "scalability to your needs or situation," he said.

AGAINST THE GRAIN?

Analysts are sceptical about whether most people crave a mix-and-match approach. "Modular devices are moving in the opposite direction from more than ten years of mobile innovation," said IHS analyst Ian Fogg. "Device makers have minimised the size of their devices and improved reliability by removing all moving parts such as removable batteries, hinges on flip phones, slide-out keyboards, often dropping memory card slots, too."

Take Apple, the most successful mobile and smartwatch maker. Its devices are "completely integrated" and feature no moving parts or replaceable components, Fogg noted, adding that this approach has worked across MP3 players, smartphones, tablets and even laptops. "Apple's success with tight integration has driven all of its competitors to pursue a similar industrial design strategy, and drop the flexibility of modular designs," he said.

Consumers have traded the ability to upgrade or personalise devices for slimmer, sleeker devices, he added. "The challenge for companies seeking to make a modular device... is how to match the competition in size and weight while maintaining the same quality components," he explained. "Early signs from Project Ara indicate Google has not solved this problem. The pre-beta designs are notably bigger than similar smartphones that are tightly integrated."

While Fogg insists his first impressions of the Blocks smartwatch are good, he said it will be difficult to keep the modules robust and reliable without adding "significant bulk" on the wrist. "The likely outcome will be a bulkier strap design than competing smartwatches," he said.

Aside from the difficulty of keeping devices slim enough to wear, modular designs raise other issues. Didenko said he and Tahmasebzadeh worked for two years with partners to build "strong and robust" connectors and develop a suitable communication protocol, while Acer's Linnig said the main challenge was to "make sure that all the blocks work together with the magnetic connector" without interfering with the components.

Affordability is another problem. The



▲ The Blocks smartwatch allows users to make contactless payments via an NFC module

base Blocks smartwatch is currently selling for US\$295 on Kickstarter. This includes four modules, with extras at US\$30 each. For comparison, the Pebble Steel costs only \$250.

LONG-TERM INVESTMENT

Not all consumers will be willing to pay more for flexibility, but Didenko notes that modular wearables may well have a longer lifespan. If your Blocks is missing a feature you decide you can't live without, there's no need to shop for a new watch – you can simply add another module. "They'll be made to last," he said.

Right now, Didenko argued, rivals'

products aren't. "The way tech companies and hardware manufacturers work today, they purposefully make devices that are not meant to last," Didenko said. "They do this because they need to ship another device next year and make you pay an extra \$500 or something for your phone. The whole business model is built around building devices year on year that are not able to last, because otherwise they won't get their revenue stream."

"We're trying a great alternative. We're building devices that will last, and because they're modular we will get extra revenue from extra modules [when customers upgrade]," he said "We're making it good for our customers." ●

BITS AND PIECES: MODULAR HARDWARE AVAILABLE TO BUY SOON OR NOW

BLOCKS

The Blocks core is no different to any other smartwatch, but you can add modules via the strap to extend its powers. The modules are hot-swappable, so you can pop in a heart-rate sensor before heading for a run, but leave it off the rest of the time to save battery. Blocks runs Android, but also works with iOS. It currently costs US\$285 for the base watch plus four modules, with extras priced at \$30. It's expected to ship next spring. tinyurl.com/o65yudq



ACER REVO BUILD

The Revo Build is a mini-PC that lets users customise, without cracking up the chassis, by stacking "blocks" with different features to the base unit. At launch, the only extra module available is a 1TB hot-swappable hard drive – easily added to any PC via a USB cable – but there are plans for a wireless power bank, an audio block, a projector, better graphics and more. The Revo Build will come with Intel Skylake Pentium or Celeron, as well as 8GB of RAM and 32GB of flash storage. tinyurl.com/nb98nah



FAIRPHONE 2

Having pipped Project Ara to release, the Fairphone 2 is the first modular smartphone you can actually buy. Unlike most modern phones, you can open it up, replace the battery and unscrew and upgrade components such as the camera and speaker – because they're not glued in, the phone is easier to repair. The back cover can also be replaced, and versions with NFC and wireless charging are being considered. The Dutch design will cost €525 and start shipping in December. fairphone.com





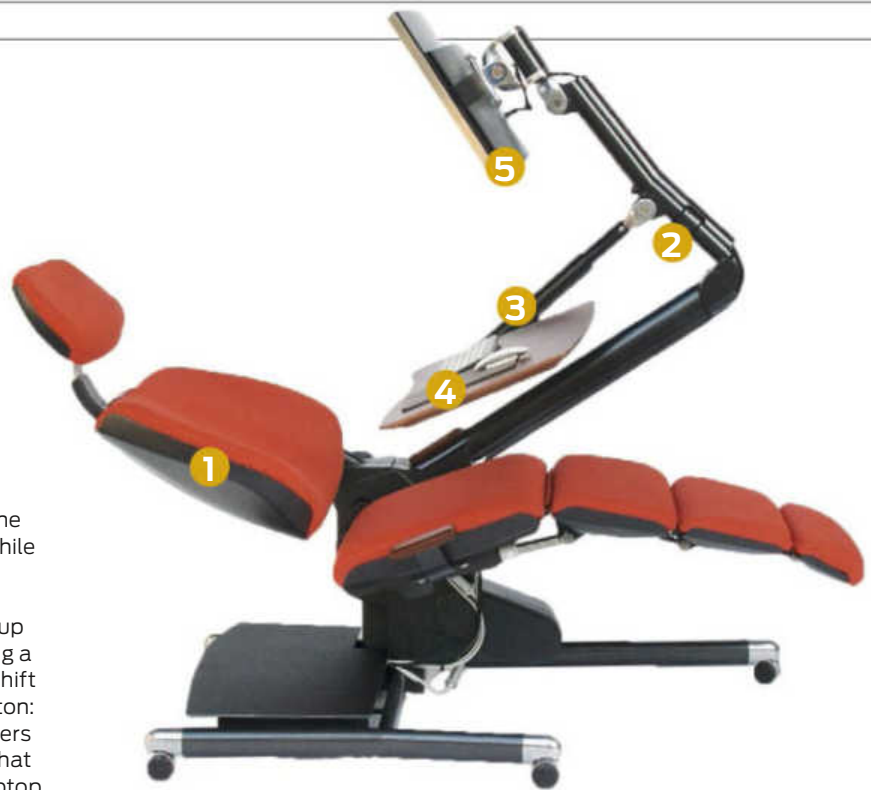
IS THIS THE FUTURE OF DESKS?

Altwork's smart workstation gets you into the perfect position to type

Lying down on the job isn't normally encouraged, but one startup has created the ultimate workstation to do just that – all while still comfortably typing away.

Research suggests sitting all day at work is unhealthy, and standing desks are now popping up in offices. But Californian startup Altwork is taking a more flexible approach. Its Altwork Station can shift into four different positions at the touch of a button: sitting normally, standing, collaborating with others by sharing your monitor, or – and this is the one that grabbed our attention – laying back with your laptop held in position above your head. While that's likely to help ease complaints such as back pain or wrist strain, the company admits there's no "ergonomic data we know of" that shows working in a reclined position is healthier than sitting. Instead, it argues that the real benefits come from changing position, rather than sitting the same way all day.

Good luck getting your boss to approve an Altwork Station for your office, though. The first version will cost US\$5,900, although there's an early adopter discount that knocks \$2,000 from that price. It will start shipping internationally at the end of next year.



1 The Altwork shifts into four positions, including the reclining "focus" mode.

2 Users can easily move through the positions using buttons embedded in the desktop.

3 When you lean back, your keyboard stays in place using magnets that adhere to a steel plate under the desk.

4 It comes with a steel mouse pad to magnetically hold your mouse when not in use.

5 The Altwork Station supports multiple monitors up to 16kg in total weight, and a side mount for laptops, but the designers didn't include a cup holder for coffee.

LEARNING TO HACK THE INTERNET OF THINGS

The rush to create the Internet of Things (IoT) means manufacturers are cramming connectivity into everything – without making it properly secure. That makes Ken Munro's work easy: he's a researcher with Pen Test Partners and spends his days poking holes in so-called smart devices. Do we really need our kettles to connect over Wi-Fi? If we do, how can we make them more secure?

That's what Munro is trying to answer – and while he's not sure a kettle or coffee maker needs net access, there's one upside to his work: that he gets a cuppa at the end.

Why did you want to hack the iKettle?

Because it had the word "internet" in front of it. Why on earth would you internet-enable a kettle? I mean, it's just a ludicrous concept – it's a Wi-Fi kettle as well. It doesn't work on mobile data, so it's not as if you can tell the kettle to boil as you're leaving the office with the intention of it being warm in 15 minutes' time when you get home.

You can only tell it to boil when you're on

the same Wi-Fi network, so it can be certain that you're in the house.

What did you find when you hacked it?

For us, it was as bad as it gets. In order to set the kettle up on your Wi-Fi network, you need to give it the network key. And we discovered that, by sitting outside someone's house, you could send a deauthentication message to the kettle, create a fake access point and the kettle will then join you. So that was a "fail" in itself.

A user had configured the device with an Android mobile application. It failed to change the passwords to the interface after you set up the kettle. It was still the manufacturer's default, which is six zeros, which you can find in the manual for the Wi-Fi module.

The consequence of that is, once you've got that password, the kettle would then disclose the user's Wi-Fi key. Once you've got that, you have basically got everything you need to compromise the user's network. And now I have control over their DNS. And once

I've got control over DNS, I've got control over all of their internet traffic.

But you would need to be sitting outside their house?

It's mitigated to a point because it's local. I've got to be adjacent to the house. However, you can also use information collated on websites such as wigle.net to geolocate victims. You can find out if someone's got a kettle from online databases and go out and find people to attack. And that's a bit creepy.

Is that what you expect to find with the coffee machine you're hacking?

That's what we're hoping to find – or hoping not to find. But, again, all of these devices deal with heat. Is there a way to bypass the thermal overrides within these devices and make them overheat? Is that going to be possible? I don't know. This is speculation at this point. One of the other devices we're working on at the moment is a Wi-Fi-enabled oven. So, obviously, the heat involved is a lot greater.

FUNKY SCIENCE

Here are the top stories from this month on the innovations that are just over the horizon.



DEAD SCARY: HOW GAMES DEAL IN TERROR

Why are games so good at scaring us, even when we know it's only pixels on a screen? Developers use a range of graphical tricks to horrify us while playing, but it's not the visuals that make the joypads jump out of our hands, according to Thomas Grip, creative director at Frictional Games. "Sounds sound a lot more real than how graphics look," he said. While an unseen monster's sinister breathing might spark terror, developers must still make the monster frighten us when it steps on screen, and for that they're turning to artificial intelligence. "If the AI does something stupid, it breaks the horror illusion and the enemy isn't scary any more," noted Falmouth University games researcher Michael Cook. tinyurl.com/ofpfvad

APPLIANCE OF SCIENCE TO OUR JUSTICE SYSTEM

Is our faith in the justice system misplaced? Psychologists suggest yes, saying people aren't sceptical enough about barristers and biases. To help, courts need to mimic scientific solutions. Professor Tim Valentine of Goldsmiths College said police should use "blind" video lineups for suspect identification by witnesses, in which even the police officer doesn't know who the criminal is, eliminating any chance of accidental encouragement. "This isn't a radical idea: clinical trials of drugs have been run blind for years," he said. tinyurl.com/pxrey7r



SMART HOMES STEP OUTSIDE

There's more to the Internet of Things than smart homes. At Intel's IoT conference in San Francisco, the chipmaker showed off other use cases, including sensors to help keep firefighters safe by measuring heart rate, carbon monoxide levels and temperature, and by tracking their location. Connected sensors can also help boost agriculture, improve security for shops and monitor children. tinyurl.com/ospabw3



CROWDFUND THIS! OPENROUT RASPBERRY PI ROUTER

Our pick of tech projects on Kickstarter and Indiegogo

The Raspberry Pi can pretty much run anything, eh?

The low-budget computing board is at the centre of many crowdfunding projects, including this open-source router designed to connect all your devices, including smart-home and Internet of Things (IoT) gadgets.

Do I really need a router that does Internet of Things rather than just, you know, the internet?

Probably not yet, but routers are starting to load up on features ahead of the predicted IoT explosion – Google has even made its own, the OnHub. To make sure it can reach all those Bluetooth-enabled IoT devices in the home, multiple Openroute devices can be linked together to create a Bluetooth mesh network.

Does it offer anything to people who don't want a Wi-Fi dustbin?

Most routers aren't very secure, as they've been designed for ease of use rather than keeping networks safe. The Openroute has a host of security features, including a physical button to access settings, so hackers can't get into the management console by entering the default gateway address and logins.

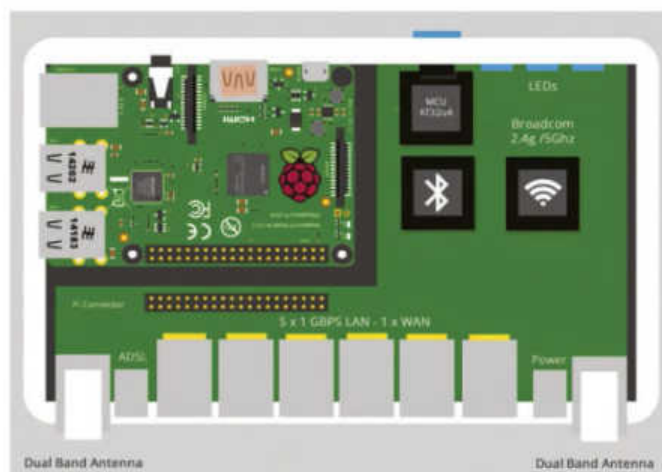
And for all this you need a Raspberry Pi?

The computing board manages the router, but also acts as a mini private cloud, letting you store up to 25GB of files that can be accessed online. You can plug in an external hard drive for more storage space. When the Raspberry Pi is updated, you can easily upgrade the router.

Will this get backed?

Its prospects weren't good at the time of publishing, with just one backer for the \$100,000 goal. It's a flexible funding model, meaning the developer will get all of the cash, even if that target isn't met. If you want an Openroute, it'll cost \$200, but you can also show your support by voting with \$1 for an alternative name, Blurroot – which we prefer to Openroute, though not enough to enter our PayPal details.

Link: tinyurl.com/gte2mpp



DVD CONTENTS

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APPLE ITUNES + DROPBOX + FLUX +
GOOGLE CHROME + MOZILLA FIREFOX
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INTERNET

+ VUZE + DROPBOX + GOOGLE
CHROME + MOZILLA FIREFOX +
MOZILLA THUNDERBIRD + SKYPE +
STEAM

LINUX

+ PUPPY LINUX

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of the software products on the discs. Use of these discs is strictly at
your own risk.

6 MONTH FULL VERSION

DRIVER BOOSTER 3 PRO

IObit's Driver Booster is a simple and
straightforward tool which can scan
your system for outdated drivers, then
download and install replacements
with a click. Upgrade to the Pro version
and you gain additional features such
as backup, faster download speeds and
wider hardware support.

The program is unusually easy to
use. There's no complex interface, no
searching around trying to decide what
you need to do: just launch Driver Booster,
it immediately scans your PC, and a
detailed report appears a few seconds
later.

You can then click the "Update" button
individually for particular drivers, handy
if you want to keep precise control over
exactly what's going on.

Or if you're in a hurry, just click "Update
Now" and Driver Booster will download
and launch each update. Thanks to a
silent update mechanism, you no longer
have to manually wade through each
and every driver update package, but
do expect to reboot at the end of the
process.

It's incredibly simple to use, but more
experienced users will find plenty of
tweakable options available should they
need them.

Note that Driver Booster 3 PRO only
works in 'Professional' mode after
inserting your serial code.

REGISTRATION & INSTALLATION:

- Download and run driver_booster_
setup.exe
- There will be multiple offers for readers
to install other applications by the same
software company, you may opt out
of these offers and continue to install
Driver Booster 3 Pro.

Congratulations! You have unlocked
Driver Booster 3 PRO! Please note that
this is a 6 month full license.

For support of this software, please
direct your queries to:

<http://www.iobit.com/en/faq.php>

REQUIREMENTS:

- Windows XP, Vista, 7, 8, 10 32/64-bit
- 50 MB hard drive space

LIMITATIONS:

- 6 months license.

<http://www.iobit.com/>

FULL VERSION

POWERARCHIVER 2015 STANDARD

PowerArchiver is an archiving tool which
crams an array of powerful features into
an appealing, easy-to-use interface.

You've no worries about file formats
here, for instance, as the program
supports just about everything. You get
read/ write support for ZIP, ZIPX, 7-ZIP,
CAB, LHA (LZH), TAR, GZIP, BZIP2, ISO
(ISO9660 and UDF "PRO only"), BH,
XXE, UUE, yENC, and MIME (Base 64),
and read/ extract support for RAR, ARJ,
ARC, ACE, MSI, NSIS, CHM, DMG, RPM,
CPIO, VHD, XAR, LZMA, SquashFS,
CramFS, ZOO, WIM plus ISO (ISO9660
and UDF) disc image formats.

PowerArchiver offers exceptional
security, too. As well as fully supporting
the standard ZIP AES encryption
standard (128/ 192/ 256-bit), its own PAE
standard supports encryption with five
different methods: Blowfish (128-bit),
DES (64-bit), Triple DES (128-bit), AES
128-bit, and AES 256-bit. The program
even has FIPS 140.2 Certification for extra
reassurance.

If you're more concerned about the
program's practical benefits, there are
plenty. It's extremely fast, for instance.
VSS and UAC elevation support mean
it can cope with problems where other
tools fail, compressing files even if they're
in use and need administrator access
to read, and there are tools to repair
archives, convert them between formats,
create self-extracting archives and a
whole lot more.

REGISTRATION & INSTALLATION:

- Download and install powarc150403.exe
- While you wait for the installation to
complete, point your browser to: [http://
pa2015.disc.pcauthority.com.au/](http://pa2015.disc.pcauthority.com.au/)
- Once the website has loaded, create or
login to your account and register for a
serial key. You will need this to register
your copy of Power Archiver 2015./li>
For support of this software, please
direct your queries to: [http://www.
powerarchiver.com/support/](http://www.
powerarchiver.com/support/)

REQUIREMENTS:

- Windows XP, Vista, 7, 8, 10 32/64-bit
- 10MB hard drive space

LIMITATIONS:

- Registration Required
- <http://www.powerarchiver.com/>

FULL VERSION**TAGMAN 2016**

Is your digital music collection a mess, tags missing, file names inconsistent or just plain wrong? This makes it much harder to organise your MP3s and find what you need, yet the problem is so time-consuming to fix manually that you'll probably just decide to live with it.

There is another way, and it's called Tagman, a smart application which can automatically bring order to the most tangled of music collections.

Just point the program at your MP3s, click "Recognize...", and it goes to work, creating a digital fingerprint of each file and identifying it with the aid of a web database.

Tags will be set, cover art downloaded, and the results displayed for you to check. If you're happy, all the new data can be saved with a click.

There's an option to automatically rename your files, too. No more "track1.mp3", "track2.mp3" - just choose the file name pattern you prefer (Artist - Title, Track Number - Title, Title - Album and more), and Tagman will rename all your selected MP3s to have the same naming structure.

Keep in mind that the fingerprinting and recognition process can take a while, and if you're scanning thousands of MP3s then you might have to wait a few hours for the process to finish.

Tagman does try to predict how much longer you'll have to wait, though, and if it's longer than expected, you can simply click "Cancel" and try again with a few less folders.

REGISTRATION & INSTALLATION:

- Download and install tagman_cm_gb_02_2016.exe
 - During our testing, we were not prompted for a registration key. However, these instructions were included to us:
 - Get your registration code within the application. Note that if you've previously registered an Abelssoft full application, you won't need to register a second time.
- For support of this software, please direct your queries to: <https://www.abelssoft.de/en/contact>

REQUIREMENTS:

- Windows XP, Vista, Windows 7, or Windows 8

- 40 MB hard drive space

LIMITATIONS:

- Registration Required.

<http://www.abelssoft.net/>

FULL VERSION**WEBSITE X5 V12 HOME**

WebSite X5 is a powerful application which makes it easy to create top-quality responsive websites, even if you've no design or coding experience at all.

The Evolution version offers more than 1,000 professional templates covering just about every site type and topic area: e-commerce, blogs, sports sites, animals, food, movies, web portals and more.

Choose a design which appeals and you then plan your site's structure using a map.

From here, it's a case of populating each page in turn by dragging and cropping various elements onto your page. There are text blocks, images, galleries, tables, video and audio widgets, maps, Flash animations, product catalogues, email forms and more.

Each element can be styled in many different ways. The program doesn't embed an image, for instance - you're able to define a quality setting, resize method, apply a host of smart mouseover effects (like zooming in and displaying custom text), and even use some basic protection to prevent a browser copying the image. (Although of course if someone's determined to save it they'll quickly find some other way.)

Your project may be previewed at any time, or uploaded via a built-in FTP engine for more testing. There's even free web hosting.

While it's focused very much on ease of use, WebSite X5 also has plenty of more advanced options and settings

REGISTRATION & INSTALLATION:

- Download and install wsx5_home_pcauthorityhm12uk.exe
- While the software is installing, point your browser to: <http://www.websitex5.com/magazine/pcauthorityhm12uk>.
- Create or login to your account.
- Once you have logged in successfully, you will be presented with your registration code. During our testing, we were not prompted for the registration code.
- Instead, we were prompted for our Websitex5 account login details during the installation process.

For support of this software, please direct your queries to: <http://www.websitex5.com/en/support.html>

REQUIREMENTS:

- Windows XP, Vista, Windows 7, or Windows 8
- 20 MB hard drive space

LIMITATIONS:

- Registration Required
- <http://www.incomedia.eu/>

FREE FULL VERSIONS: Each month, we offer *PC & Tech Authority* readers full registrable versions of some software on the DVD. See the installation instructions in the DVD menu to complete registration, if applicable. **IMPORTANT:** Full product registration closes on 15/02/16



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FEATURE + DRIVER BOOSTER 3 PRO + POWERARCHIVER 2015 STANDARD + TAGMAN 2016 + WEBSITE X5 V12 HOME **DRIVERS** + ATI CATALYST + NVIDIA FORCEWARE **HELP** + DISCLAIMER + DAMAGED OR FAULTY DVDS + USING THIS DVD + INSTALLING SOFTWARE **EDITORIAL** + BURNING AN ISO IMAGE + PC&TA EDITORIALS **TROUBLESHOOTING** + SERIAL CODES + BLANK REGISTRATION WEBSITE + CAN'T FIND A FILE? + INSTALLATION ERROR **WINDOWS** + CCLEANER + CLASSIC SHELL + CUTEPDF + DEFRAGGLER + FOXIT READER + GREENSHOT + APPLE ITUNES + LIBRE OFFICE + OPEN OFFICE + MALWAREBYTES' A/M + SANDBOXIE + VLC MEDIA PLAYER + FLUX + 7ZIP **MAC** + ALFRED + BETTERTOCHTOOLS + APPLE ITUNES + DROPBOX + FLUX + GOOGLE CHROME + MOZILLA FIREFOX + PLEX + SKYPE + TEAMVIEWER + VLC **INTERNET** + VUZE + DROPBOX + GOOGLE CHROME + MOZILLA FIREFOX + MOZILLA THUNDERBIRD + SKYPE + STEAM **LINUX** + PUPPY LINUX

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JON HONEYBALL

"YOU'LL KNOW THEY'VE REACHED THE END OF THE ROAD WHEN YOU SEE 'UPGRADE TO WINDOWS 10 OR WE'LL KILL THIS KITTEN'"

The news that Microsoft is going to be even more insistent in 2016 could leave a very sour taste in the mouth

Microsoft's intention to aggressively push Windows 10 onto more of our machines leaves me with very mixed feelings. On the one hand, I genuinely can't imagine why anyone with Windows 8/8.1 would want to stick with it when Windows 10 is so much better. However, I also agree that downloading a wodge of a Windows 10 install to people's computers without asking is "courageous", as Sir Humphrey would say. It's neither Microsoft's disk space nor its internet bandwidth that's being spent (what if it's over a cellular Wi-Fi dongle, or hotel Wi-Fi because you happen to be on holiday?). The news that Microsoft is going to be more insistent in 2016 could leave a very sour taste in the mouth.

On the other hand, I understand the problem. Microsoft is desperate, utterly desperate, to get users off Windows 7 and Windows 8 and onto 10. There's no downside involved in this because it cuts costs, solidifies the customer base onto the latest platform, makes things easier for developers, and is a good PR story. Decide for yourself in what order those things are ranked in the mind of a Microsoft board director. So I'm caught between the same rock and hard place as Microsoft itself: push hard and take the flack (but gain the benefits) or be a gent and let things grind on.

Unfortunately, for many people, the move up to Windows 10 simply isn't compelling enough. If Microsoft had bundled a free Office 365 Home licence with every Windows 10 upgrade, that would have really sweetened the deal, but whether it dares – given past Department of Justice investigations and monopoly abuse judgements – is entirely

another matter.

What I think the company ought to do and what its lawyers will let it do could be two very different things. I don't expect Microsoft to back down, however, as its entire strategy for operating systems (outside of the large commercial environment) revolves around the ability to get Windows 10 onto everyone's device. Without that, there's absolutely no hope of getting anyone to take Windows 10 Mobile seriously, and the tablet opportunities will continue to look feeble and be overshadowed by the massive sales of Android and iOS. So expect to see your router lights flickering soon. Expect Microsoft to bypass any "no, I don't want you to download it" settings you might put in play. Expect the adverts to start flashing across your screen. You'll know they've reached the end of the road when you see "upgrade to Windows 10 or we'll kill this kitten", and I wouldn't be surprised if we get there eventually...

APPLE CPU

You might have been reading on various online hysteria farms (sorry, "news websites") about problems with the iPhone 6s and 6s Plus processors. It appears Apple decided to use two different CPU foundries to make the core CPU for the new phones (TSMC

and Samsung), that they differ slightly in physical size, and that the Samsung version uses what might arguably be termed a more bleeding-edge fabrication technology. I wrote about the issues of supplier component ramp-up in last month, and since then I've been able to check this out for myself.

The problem came about because people have been running Geekbench's battery test and discovering a significant difference in battery life that's wholly correlated with the CPU fitted to your phone. Samsung devices appear not to last as long as TSMC ones. I've been doing my own tests on my 6s Plus and a friend's model, which is identical to mine except that his has the Samsung chip while mine has the TSMC chip. There's nothing you can see from the outside to tell which CPU is fitted, and you can dig as deep into the Settings panel as you like, but there's nothing there – you need a small applet called Lirum Device Info Lite to tell which component is in your phone.

Now for the problem. I can replicate the issues as described with phones belonging to myself and my friend, but, at this point, we have to be very careful indeed. While a wholly synthetic benchmark designed to stress all the CPU cores, using a very tightly looping calculation, might be of interest to



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@jonhoneyball





Last time I talked to Klein, it cost around \$12,000, which is perfectly fine for a reference-grade measurement tool for a laboratory.

Back in the real world, though, the X-Rite iDisplay 2 kit is a more likely choice. It comes in various flavours, but a full-house kit that can do screens, print-

“For many people, the move up to Windows 10 simply isn’t compelling enough”

outs, projectors and more costs around \$2,500, and then there are cheaper devices for a few hundred pounds. I’m not sure I’d trust a spectrophotometer that came with a two-digit price tag, to be honest. I have an iPro 2 and it’s a great piece of kit.

For measuring screens, the best software comes from SpectraCal, whose CalMAN software is the benchmark against which others are measured. It might surprise you that the basic CalMAN ColorChecker software is free. In less than five minutes, you can measure over 300 colour points and pattern changes, and then it will tell you what’s happening with your screen. Creating a correction ICC profile does cost money, but, at US\$199, it’s really not much when you consider the cost of wasting photo-paper prints, or of making a colour decision that’s just plain wrong in, say, the fashion biz. ColorChecker scales up through various versions to the big daddy, the Studio product that does just about everything you could want from a desktop computer, including writing out the colour-calibration files directly into the memory of colour-calibrated monitors from companies such as Eizo. It was the work of just ten minutes to run the software and measure my Eizo

▲ The difference between the Samsung and TSMC processors is of little relevance to most people

those who also collect engine numbers from the front of trains, it’s of very little relevance to anyone else. I ran both 6s Plus devices through a set of realistic end-user workloads, and by the time I got really bored, the charge remaining on one phone was 14%, and 15% on the other. Nothing to get excited about.

As I said last month, fabrication yield is a really big economic issue for a supplier the size of Apple, so dual-sourcing is imperative simply because no-one is big enough to supply the entire shipment. For myself, I’m entirely uninterested in the whole matter, having shown to my own satisfaction that there’s nothing to worry about, at least this time around. Some other time, some other set of circumstances and the outcome might prove different. And my friend with the 6s Plus and its Samsung chip merely shrugs his shoulders and proclaims it to be the best phone he’s ever owned. I’d have to agree with him, though some of the work being done in the Android world, especially by Samsung with its new screens, is truly breathtaking. It’s hard to overlook, despite the limitations of the OS, infrastructure and application offerings.

COLOUR TESTING SCREENS

Let’s be clear, there’s calibrated and uncalibrated. There’s no middle ground. When it comes to screen performance and colour accuracy, setting by eye simply isn’t good enough. It might get you close and work reasonably well, but there’s still calibrated and uncalibrated. Doing it right involves measuring the performance of the screen itself, using a

proper spectrophotometer tool and the right software.

The required hardware can range from the relatively inexpensive all the way to the sublimely expensive. There really isn’t anything much better than the Klein K10-A – you point it at the screen and the device measures it within a fraction of a second. It doesn’t look at the whole screen, as you need only look at a small area measuring 43mm² in contact with the screen, 60mm² at 10cm and 75cm² at 4m from it. You can choose how close you want to be and how small the measurement spot becomes, and it will measure from 0.00006 to 10,000cd/m², which is the darkest blackness you can image, to something so scorchingly bright it would make your eyeballs hurt. Peak white on an iPhone 6s Plus screen is around 570cd/m², so 10,000 is like looking straight into a floodlight.

Of course, the Klein K10-A is a precision instrument and its cost is astonishingly reasonable, if you need it.



▲ Point the K10-A at a display and you’ll know its colour accuracy in a fraction of a second



30in reference monitor using the iPro 2 device, then to inject the calibration values directly into the monitor's memory.

For me, the US\$2,995 I paid for the Ultimate version has paid for itself many times over – this “everything including the kitchen sink” version is for serious professionals, and you can even calibrate multi-panel display walls with it if you want. You can calibrate all of the devices in your office too, which is critically important if you're moving photos from one device to another. It comes with ten desktop client licences, and you'll need to run its software widget on each target computer to display the patterns, but they only cost \$49 per device once you've used the allocated ten licences. It's interesting that SpectraCal also offers iOS and Android widgets for free, so measuring your iPhone 6s Plus' screen is a snap and the results are very good indeed. No-one should have any problems with the colour accuracy of a standard iPhone 6s or 6s Plus, as it's as good or better than many of the high-end monitors out there. And I'm very much looking forward to measuring the forthcoming iPad Pro.

So colour accuracy is either right or wrong, with no grey area between (geeky joke opportunity missed there). SpectraCal CalMAN is the place to go for the best calibration software and the iPro 2 is worth its weight in gold, but I can see a purchase of a Klein K10-A in the near future. Why? The iPro 2 requires its sensor head to be in direct contact with the screen if used against a computer screen (it's different for a video projector), but I'd like to be able to take off-axis measurements to see how well the picture quality drops off when you turn a screen vertically and horizontally.

✓ The Logitech Bluetooth Easy Switch Keyboard has a nice action and feels solid

Some tablets and smartphones have truly terrible off-axis performance, and it would be nice to know just how bad they were from a measurement perspective. For that, the Klein is the best. But please keep an appropriate sense of perspective – the SpectraCal software, and its bundling of the cheap SpectraCal C3 colorimeter for only \$149, is a great place for an enthusiast to start.

APPLE KEYBOARD AND TRACKPAD

I bought Apple's new keyboard and

“We need to have the ability to do far more aggressive pre-caching of data feeds”

trackpad, and boy am I disappointed. Let's start with the keyboard. It's horrible (which is odd because I quite liked the keyboard on the MacBook). It has tiny vertical movement, but that somehow feels appropriate for a device that's only as thick as a sheet of paper and can almost be put in a large coat pocket. When used with a 27in desktop monitor and a huge multi-core Mac Pro, it's somewhat pathetic and just feels like a toy. I'll confess I used it for about 30 minutes and then put it to one side, never to be returned.

The new Apple trackpad is more interesting, although I find the whole Force Touch thing hard to get on with for a desktop. I don't mind it at all, indeed I quite like it, on my 6s Plus where it makes sense, but on a trackpad for a desktop computer it just felt odd. And the whole “click and then click through yet again” gave me a headache. I've turned off Force Touch, and the product feels the better for it.

Meanwhile, I've also bought Logitech's Bluetooth Easy-

Switch Keyboard. Now this is clever: it can pair with up to three devices and you switch between them with simple key presses. It has a nice action, feels solid and is usable in every way that the new Apple keyboard isn't. It gets my vote for any application that needs a compact Bluetooth keyboard.

MORE HARDWARE AND UPGRADES

Firstly, a shout-out to the wizards down in Salisbury at Naim Audio. I've written about my delight at Naim Audio's

Mu-so network streaming speaker system before. It's an absolute beauty. It's head and shoulders above anything comparable, and so completely dominates the field that all else is gaslight.

A special pat on the back goes to the software-development team: keeping software bug-fixed and also investing the time to add new features, across Windows, Android and iOS, isn't easy for a small team. But they're doing a sterling job. Most importantly, they listen to feedback and then implement changes.

The latest upgrade allows the Mu-so to stream very high-quality (CD-quality) streams from the Tidal music service. I have to say I'm very impressed with this, especially as it has an offline feature on the iPhone client. The quality of the mastering seems very good, and the performance through the Mu-so is truly excellent. App integration is also spot on, so full marks to Naim for its development work.

I wish I could say the same for Apple's vaunted Beats 1 service. I listen to background music via a Bluetooth link between my phone and motorbike helmet on long journeys, and it's fascinating to hear just how badly 3G and 4G networks cope with the sort of continuous streaming demanded by Beats 1. Even major roads appear to have coverage so poor that the stream keeps dropping out. I'm very disappointed by this because what clearly works well here – and doubtless works just as well in Seattle and Silicon Valley – doesn't hold up well hereabouts. We need to have the ability to do far more aggressive pre-caching of these data feeds to allow for interruptions that could last for minutes at a time. Real-time streaming is a fallacy, as there are very few occasions when a truly real-time connection is required – listening to a live sporting event is one of the rare exceptions to the rule. News, entertainment and other general programming, for example, don't need to be absolutely synchronous. ●



PAUL OCKENDEN

"ONCE LIMITED TO THE UNDERWATER LAIRS OF BOND VILLAINS, HOME AUTOMATION IS GOING MAINSTREAM"

Choosing a home-automation system can be confusing, but it doesn't have to be difficult – or expensive

Once limited to the underwater lairs of Bond villains and clumsy demos on *Tomorrow's World*, home automation is at the tipping point of going mainstream. I predict that, in a year or two, it will definitely be a booming growth area.

Let's take a look at the state of home-automation technology, bearing in mind that many of the products and techniques can be as useful in SME as home environments. It's a topic that normally generates lots of feedback when I mention it, so I'm guessing there's a fair bit of interest, but if you're just starting out you might be finding the numerous options perplexing.

For example, you'll find numerous standards on offer – LightwaveRF, Z-Wave, X10 and more – each supported by various manufacturers. On top of these, there are many proprietary versions from manufacturers. Then, just when you thought it couldn't get any more confusing, there are the offerings from big players such as Samsung (SmartThings) and Apple (HomeKit), that have recently entered the automation space. The options available are simply too bewildering, so it's no surprise many people walk away. My advice is this: decide what you need to do, then find a reliable, easy-to-use but low-cost way to achieve it. Ignore the standards and find something that works, so that when something better appears in two years' time it won't cause you too many tears should you decide to upgrade.

I've recently been playing with some devices made by Energenie. Unlike some of the kit I write about in this column, they weren't sent to me by a PR agency hoping for a few column inches: they're products I went out and bought out of my own pocket. You'll

find many companies selling remote-controlled mains plugs, which enable you to plug in lamps or other appliances via adapters and supply an RF remote control to switch these appliances on and off. Energenie was a purveyor of just this kind of device a couple of years ago, but it has continued to innovate, creating products such as a four-socket extension lead in which each socket can be switched individually.

The real masterstroke came when the company started opening up its system to external controllers. Initially, this took the form of a small circuit board called the Pi-mote, which, as you might guess from its name, is an add-on for the Raspberry Pi. This allowed you to switch sockets on or off using simple scripts, which is where you may start to see possible applications for small businesses.

Imagine you have a temperamental broadband router that works most of the time but locks up once a month and can only be fixed by cycling the power. Imagine, also, that your ISP won't let you swap this router for an alternative model. The solution? Plug the flaky router into the mains via an Energenie power adapter, then place inside your network a Pi-mote-equipped Raspberry Pi that's set to ping an external site every few minutes. If these pings fail, say,

➤ Energenie's power adapter can be used with a Raspberry Pi to mend dodgy Wi-Fi

twice in succession (to allow for external glitches), run a simple command to power down the router, wait a few seconds then power it up again. This setup would cost less than \$100, plus perhaps an hour's worth of time to get it all configured.

With a bit of imagination, you can see how something like this might form the basis of a simple home-automation system. You might turn lights on at certain times of the day, for example, or use a few simple calculations to turn them on at local sunset rather than a fixed time.

However, with only simple sockets and one-way communication from a Raspberry Pi daughterboard, your options quickly become limited. You can expand them a bit by using a couple of product updates: an RT version of the Pi-mote board that performs two-way communication, and an updated socket that measures voltage, power (apparent



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and reactive) and frequency.

This arrangement means you can switch a heater on and off, say, but also detect and respond to the warmth of the room. You could also detect whether your TV is switched on, and adjust your audiovisual system or Velux blinds accordingly. In an office environment, you might only turn on your wireless printer/scanner if your PC is also switched on.

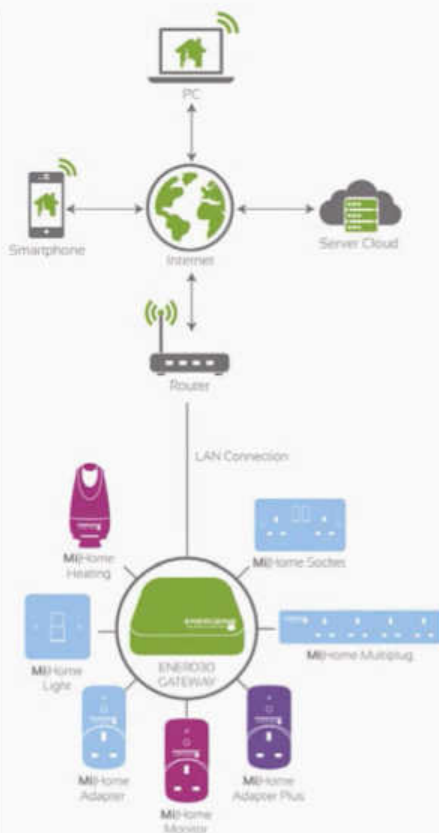
This still doesn't overcome all the limitations, though – there's no way to interact with the system remotely, which is what you need for a proper automation system. Enter Energenie, which has recently refreshed some of its older products by adding brilliant new facilities and packaging them under the sub-brand MiHome. (Actually, it's called "MiHome", but *PC & Tech Authority's* house style doesn't allow for such branding frippery.)

The MiHome system includes all the bits I've just described – remote-controlled sockets, one-way and two-way Pi-motes, and monitoring – but it also adds many more abilities.

At the heart of a MiHome installation is a gateway box that connects to your broadband router and talks to the various MiHome devices scattered around your home or office. This gateway communicates with an Energenie-operated cloud infrastructure, which includes a web interface that you can use to control your devices from wherever you happen to be, and to view stuff such as historic energy consumption. There are also apps available for both iOS and Android devices. Alongside the various plug-in adapters, the range of sensors and controls has been expanded to include the likes of current clamps that monitor your whole-house consumption, light switches, wall sockets, relays for other devices and even radiator valves – meaning you could use it to build a poor man's Evohome system.

You can pair new devices with your system using the mobile apps or the website. Either way, the wizard-like walkthrough makes it really easy, so you don't need to be a techie. The mobile apps also include a geofencing facility so you can, for example, turn on your driveway lights as you approach your house, or make sure the TV is switched off when you leave the room. If you work from a small office, you could use this facility to switch the kettle on just before you arrive.

It works very well. My only complaint is that the whole-house sensor is a bit dumb. It has only one current clamp, so

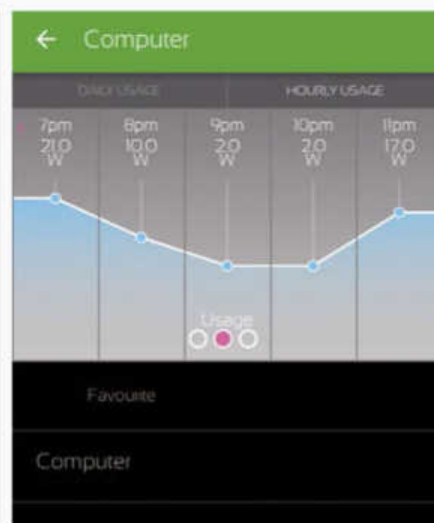


▲ MiHome is a cloud-based home-automation ecosystem

it can't cope with extra power sources such as solar panels. If you happen to be exporting 4kW to the national grid, the MiHome sensor will think you're actually consuming that much, since it can't differentiate between import and export. It also assumes a standard power factor, which can be a problem at night when your main loads are probably eco-friendly lighting and electronic devices. All such devices present reactive loads with crazy power factors in which voltage, current and voltage load are, to a large extent, out of phase.

This can really confuse simple current clamp meters, but there are other devices on the market that get around this problem using plugin AC transformers (OpenEnergyMonitor) or foil-based voltage sensors (Eco Eye). Combined with a second current clamp to handle microgeneration, it would make for a far more usable product, but other than that I've been very impressed with MiHome.

What really brings it to life is the fact Energenie has connected its cloud infrastructure to IFTTT, which you may remember I wrote about last month. At the time of writing, the integration only offers actions, not triggers, but the folks at Energenie assure me that these are



▲ The MiHome app is both feature-rich and easy to use – a rare treat

coming soon.

Even without triggers, you can do things such as turn on lights at sunset (similar to the Raspberry Pi example), or turn on a heater when it gets cold outside. You can even use your other home-automation products as triggers, to power down items in your home whenever your smart thermostat is in "Away" mode, for example.

This makes for a lot of flexibility, but you can go further still, because Energenie has published an API that you can use to monitor and control your devices. Since it uses simple JSON-formatted requests and responses, you can easily interface to it from almost any programming language. I've written some simple test scripts to turn sockets on and off, and, despite everything going via the cloud infrastructure, the processing delay and transmission latency is admirably short – actions seem to happen almost instantaneously.

I'm really impressed with MiHome – it's a well-thought-out ecosystem, and I'm sure it will only get better over time. The fact Energenie has made the API and IFTTT available shows that it understands the kinds of things people want to do with home automation, and even without them the mobile apps and website are well considered and attractive – something that's often missing in competitor products.

MiHome doesn't employ Z-Wave or LightwaveRF, so it's essentially a single-vendor solution, but this has pros and cons. It means everything works well together, and that it has a more professional feel than many alternative products. It's also relatively inexpensive, so it's not as though you need to worry

about a huge investment going down the pan should Energen go bust. Even if it did and its cloud infrastructure went offline, you'd still be able to use the remote control and Raspberry Pi boards.

YOU'D BETTER WATCH OUT

Regular readers may have noticed that I hardly ever mention smartwatches in this column, and they might be wondering why. Those who know me personally might be more baffled still, because for years I was known as something of a wristwatch fan, collecting various timepieces, old and new, from some of the big-name brands. You can't beat a nice movement. Smartwatches, though? Meh...

In fact, even before the advent of the smartwatch, I'd pretty well stopped wearing watches and my expensive timepieces had either been consigned to a bank vault or sold. I'd realised that everywhere I looked there was a clock: on the wall, in the corner of my computer screen, on my phone, on my cooker, on my microwave, on the radio. If everywhere I look there's a clock, why wear one on my wrist?

It's also quite liberating to go without a watch, since it's all too easy to become a slave to time and find yourself checking every few minutes. Sure, you need to get to appointments on time, but your various electronic gadgets take care of that – your phone will probably even alert you when it's time to leave, taking traffic conditions into account. A traditional wristwatch can't do that.

Then along came smartwatches and I could – sort of – see their point,

especially since they were nothing new to me. Twelve years ago, I bought myself a Fossil Wrist PDA, which was a device massively ahead of its time. It ran Palm OS (remember that?) and was essentially what it says on the tin – a PDA on your wrist.

Back in 2003, there was no way to get permanent internet connectivity on a watch, which meant no alerts for incoming messages, but it would remind you of any appointments and allowed you to look up phone numbers. You could even take notes on it using the

“The real benefit of a smartwatch is the notifications it provides as an extension of my phone”

Graffiti handwriting system.

Mine mostly stayed in its box, though, and remains pretty well unused. Why? Because, although in PDA mode the watch could last a week or two on a single charge, as soon as you switched it to permanently display a watch face its battery would be dead within a day or two. For me, that's just not acceptable. I wouldn't wear a wristwatch with a power reserve of one day, so why would I tolerate it in a “Wrist PDA”?

This remains one of my biggest gripes about most smartwatches. It's bad enough I have to make sure my phone is topped up, and I simply don't want another device that I have to worry about charging all the time.

There are other things that bug me about many smartwatches, too.

Let's start with their size and weight. I know big watches are currently in fashion, but some of these devices are monsters. It's not so much the diameter that bothers me (although they can look silly on my skinny wrist); it's more their thickness. I've received a few sent to test over the years, and I'm always bashing them because they stick out so far. In fact, I was rather embarrassed by the condition of one well-

known brand's device by the time I sent it back to its PR keeper.

I also think many of them are plain ugly, as typified by the Pebble Time, in particular the round version. Take a look at the big, fat bezel – how could anyone find that attractive?

Incidentally, I think I know why that bezel is there. If you draw a square box around the round face you'll find that it fits exactly inside that bezel, so I wouldn't be surprised if there's a square display under there and the bezel is just a facade to make the face appear round. I could be wrong, but once you see how well the box fits it's hard to ignore.

Having said all of these negative things, I must admit I now see the point of the smartwatch – and it's not for telling the time. It's not even about apps. I really don't need to control music or navigate maps from my wrist – these are things I prefer to do on the bigger screen of my phone. No, for me, the real benefit of a smartwatch is the notifications it provides as an extension of my phone, vibrating gently and flashing a message on its screen whenever I get an important message.

I suppose it's all about being lazy, but a glance at the watch tells me whether I need to take the phone from my pocket or not. If only I could find a smartwatch that wasn't pig-ugly and didn't need to be recharged every night...

You can probably guess where this is leading: I think I may well have found just such a device. For a few weeks now, I've been testing a Vector Watch. This has an astonishing battery life of 30 days (and that's not just marketing guff; it really seems to be a genuine figure) and it's a thing of beauty. It comes in oblong and round versions – yes, the round one has a bezel, but it's nothing like the monstrosity on the Pebble.

The watch, which appears to be manufactured by a Romanian company (although its marketing is very “urban” indeed), works in conjunction with a standalone app that runs on iOS or Android. It doesn't use Apple or Google's existing smartwatch systems, but rather employs a Bluetooth LE link between phone and watch to push notifications and data streams such as weather or stock reports. It offers downloadable and stylish faces.

It's early days yet, and I'll report back when I've had the watch for another month or two, but things look promising. It's quite simple compared to other smartwatches, but that's part of why I like it. I think this is the first smartwatch that I might actually be able to live with. ●



◀ Is the Vector Watch's combination of 30-day battery life and nice looks too good to be true?



IVAN POPE

"DISCOVERING MACHINES THAT COULD OUTPUT DIGITAL FILES IN REAL MATERIAL WAS A REVELATORY MOMENT"

The growth of 3D printing offers fertile ground for business. Here's how one man turned a hobby into a business idea

Like so many technologies that seem to arrive suddenly in public view, both 3D printing and 3D scanning have long and rich histories. The internet itself was over 30 years old when, in the early 1990s, the World Wide Web suddenly and forcefully brought it to the attention of a global audience. A complex history of development and research was ignored as the web seemed to arrive fully formed on day one, bringing with it thousands of business opportunities.

We have recently seen the arrival of 3D printing in the public consciousness, as a combination of patent expiry, commercial opportunity and public domain development efforts have brought an exciting technology to the mass market. Following close behind comes a technology that I find even more exciting: 3D scanning. What, I wondered, could the business opportunity be here?

I came to 3D printing about five years ago. I was looking around for something interesting to do and, as I started my life as an artist, physical objects retain a great interest to me. Discovering that machines could output digital files in real material was a revelatory moment. It was almost as exciting as discovering the global networks over 25 years previously.

It was the RepRap project (reprap.org), developed by Dr Adrian Bowyer that brought these machines into the world. Taking the view that a 3D printer should be capable of producing parts for another 3D printer, Dr Bowyer kickstarted a revolution. Using a technology for which patents had recently expired, and an approach founded on open-source philosophy, the concept of building your own 3D printer quickly went from idea to

reality: small businesses producing the printed parts, kits and software morphed into dynamic commercial enterprises such as MakerBot and Ultimaker.

A FRENCH-MADE FROG

By the time I realised that something exciting was happening, the industry was up and running. The first printer I got was a French-made Leapfrog, a state-of-the-art monster that was delivered in a wooden crate that we had to unscrew. This printer used fused deposition modelling (FDM). In other words, it took reels of plastic filament, melted them and squeezed them out like hot toothpaste

"There was a variety of public domain software available, but none of it was very friendly"

until it built up the desired model in 3D. Although sold as ready to print "out of the box", I soon discovered that there are many variables to 3D printing and that it's really not an out-of-the-box experience. I came face to face with 3D-printing software for the first time.

At the time, although there was a variety of public domain printer software available, none of it was particularly friendly. Again, I was reminded of my early internet experiences, where the complexity of actually getting online could make a grown man weep. I persevered with the Leapfrog, all the while looking around at the growing industry and wondering what the business opportunity could be. I kept hearing that 3D printing was a "solution looking for a problem", but it didn't put me off. I decided to keep looking for the problem to solve.

The thing about 3D printers, I quickly came to realise, is that they need input

to provide output. All the skill in the world with the printer and its variety of materials wasn't much use if you didn't have a 3D file to start with. And I swiftly discovered that creating the 3D file to print was harder than the printing part.

WHAT GOES IN MUST COME OUT

At the same time, it occurred to me that the input part of the equation was arguably the most interesting. Attending the first 3D printing shows in London, I was reminded, yet again, of the early days of the internet by the refreshing variety of exhibitors. These ranged from huge companies (Adobe, showing how to manipulate 3D files in Photoshop) down to individuals who were producing their own brand of 3D printer using the RepRap model.

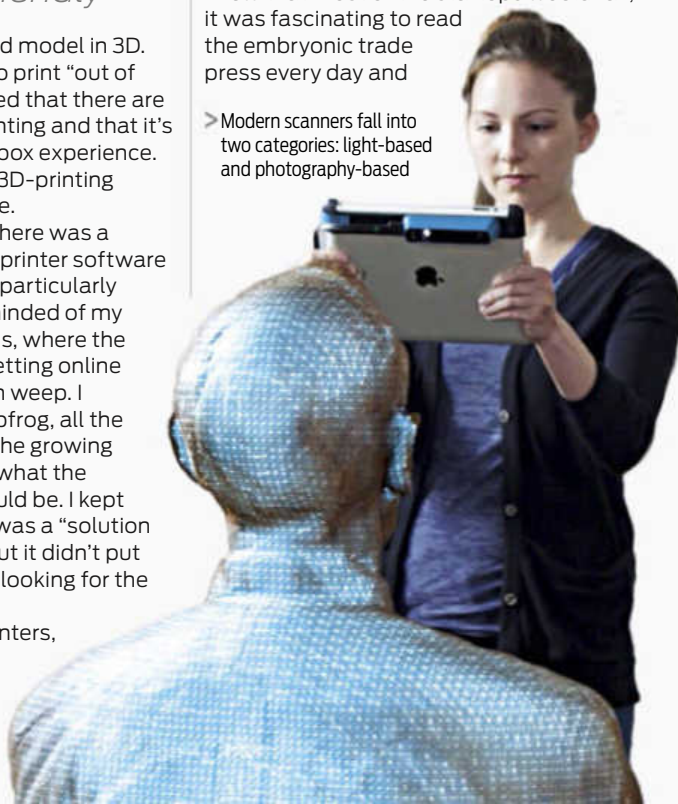
We were in the "let a thousand flowers bloom" era of the industry, and while I knew that most of the startups would fail, it was fascinating to read the embryonic trade press every day and

> Modern scanners fall into two categories: light-based and photography-based



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find out how fast things were moving.

Another element then became important: Kickstarter. Several 3D printers launched on Kickstarter and raised incredible amounts of money, demonstrating a widespread desire to own one. Alongside this networked

“A complex ecosystem of scanning has developed and continues to grow as more options reach the market”

development, I started to encounter companies that were producing networked printer tools and management systems. I was looking at the birth of a 3D-printing ecosystem, and in my quest for opportunities, I decided to shift my attention to this space.

One of the first 3D printer companies to get out of the starting blocks was MakerBot. It also started the first online 3D file repository, Thingiverse (makerbot.com/thingiverse), where anyone could upload 3D files for distribution. Although MakerBot grew fast – in 2013 it was bought by one of the big two 3D printer companies, Stratasys – Thingiverse grew even faster. There was an open-source attitude and people were encouraged to upload their creations for free. The growth of Thingiverse didn't go unnoticed, and other file repositories started springing up, including Ultimaker's version, YouMagine (youmagine.com) and CGTrader (cgtrader.com). These allowed designers to sell their files, adding that crucial commercial layer to the ecosystem.

As 3D printers started to spread, two young entrepreneurs decided to build a network that allowed people with printers to share them with those without access to a local machine. 3D Hubs (3dhubs.com) is the result of their work and now offers access to a global network of more than 20,000 3D printers, available for anyone who wants to print a 3D file.

BODY SCANNING FOR FUN AND PROFIT

Around the same time, an enterprising individual working on Coney Island, New York, designed and built his own body scanner using a Microsoft Kinect. He used Kickstarter to raise funds to scan and print every visitor to his studio. He also added the plans for his homemade body scanner to Thingiverse. The following year, I found a company, 3Dify had built its own Kinect-based body scanner and



were scanning locals and printing them out on a bunch of Ultimaker printers.

I decided to look more closely at body scanning and discovered an embryonic industry with huge potential. I was inspired by the realisation that body scanning was at the same stage as early photography: it was slow, painful and expensive, and the results weren't up to much, but the potential as the technology developed was stunning. I imagined how the Victorians who went to have their photos taken would regard the cameras in our phones, and understood that an entirely new industry might be on the rise.

The scanning industry, like the 3D-print industry, has a history that has been bound up almost entirely with high-end industrial uses and prices to match. A combination of patent expiry, low-end demand and innovative approaches is leading to an explosion of new scanners.

These fall into two categories: light-based (LiDAR) and photograph-based (photogrammetry). Each approach has its adherents and, as with so many things, it's horses for courses. Certainly, it's too early to declare a winner. Both types are being developed cheaply as a combination of hardware and software. So how can you get involved?

At the low end of photogrammetry you can use a free app called I23D Catch, which stitches together photos on your phone into passable 3D files. In light-based scanning, a company called Structure (structure.io) came up with a scanner that clips onto an iPad and again raised millions of dollars on Kickstarter to turn it into a real-world product.

For body scanning, speed of process is key: any movement during photography

▲ The 3DPI rig is built using Raspberry Pi computers

can ruin the image. A developer in Amsterdam wanted to scan his young son regularly as he grew up and came up with the idea of using Raspberry Pi computer boards, with video cameras attached, to build a large rig for body scanning. The 3DPI scanner was born (www.pi3dscan.com). Professional versions of these rigs using DSLR cameras can cost hundreds of thousands of pounds, but he managed to build a 100-camera setup for less than \$20,000. He developed his own management software for it and freely distributed the construction files, kickstarting another industry in the process. Now these rigs are available commercially from various producers.

A complex ecosystem of scanning has developed and continues to grow as more hardware and software options start to reach the market and are then integrated with the existing 3D-printing products. The 3D-scanning world encompasses dozens, if not hundreds, of sectors: health and fitness, medical, virtual reality, military, design, body printing and virtual clothing. While these industries are still embryonic, they hold huge potential and will eventually find their way into our everyday lives over the coming years.

As for me and my business opportunity? Well, my company, Shapie Me (shapie.me), hasn't yet launched, so I don't even have a product to shout about. What I can tell you is that we'll be developing a platform for the management of personal body scans. No matter what uses these scans will be put to in the future, my hope is that Shapie Me will facilitate integration. ●



DAVEY WINDER

"I CAN'T IMAGINE HOW TALKTALK COULD HAVE HANDLED THE POST-BREACH INTERVIEWS ANY WORSE"

Here are 15 expert tips to help you protect your data and avoid the schoolboy errors made by TalkTalk

As I write, I'm still shell-shocked by the TalkTalk data breach – and I'm in good company, as TalkTalk CEO Baroness Harding also appears to be suffering from PBSO (post-breach stress disorder). For me, the shock was tempered by having spent two decades in the IT security industry. When TalkTalk falls victim to a simple SQL injection attack, it might shock, but sadly it doesn't surprise.

I'm not sure whether to blame Baroness Harding or the people who sent her to face the media without being properly briefed on how to answer their questions. Admitting that you don't know whether all, some or any of the data was encrypted doesn't look good. Maybe she really doesn't know, in which case, a) what is she doing on TV answering questions? and b) why is she CEO?

Or perhaps she did know and thought avoidance was better than a straight "no". Neither would surprise me, given that TalkTalk has fallen victim to a couple of breaches over the past year and appears to have learned not much, and implemented less.

Then things went from bad to worse, while appearing to get better. Baroness Harding went on TV again to state that "the amount of financial information that may have been accessed" was "materially lower than initially believed and would on its own not enable a criminal to take money from your account". It's good that fewer people were harmed by this breach – around 400,000, not the four million first suggested. It's not good, however, that the initial post-breach plan didn't instruct company officers not to spread FUD (fear, uncertainty and doubt) and to deal only in known facts. Better to say "we've been breached and don't know how many customers are affected yet" than shout, *Dad's Army*-style, "we're

dooommed...."

More evidence of a lack of post-breach planning was the statement made by Baroness Harding to *The Sunday Times*, that TalkTalk has "complied with all of our legal obligations in terms of storing of financial information", but wasn't under any legal obligation to encrypt sensitive customer data such as bank account details. That convinced every customer I've spoken to that TalkTalk doesn't care about spending money to protect data so long as it's only the bare minimum to meet legal criteria. However, TalkTalk now says that credit and debit card data was tokenised – so they do care about data protection, they just made a pigs' ear of communicating that fact after the breach. I can't imagine how TalkTalk could have handled this any worse, and I speak as a customer, albeit of the business side of the company.

15 EXPERT TIPS

The TalkTalk breach is a prime example of why an organisation needs security awareness from shop floor to boardroom, which must be built in, not bolted on, and include a breach-response plan. When your business has just been hacked, you won't be thinking straight, and having a formal plan of action to follow can prevent the sort of schoolboy errors TalkTalk made. That's why I was happy to take part – wearing both journalist and consultant hats – in Security Serious Week (securityserious.com), which happened during the last week of October (designated as Cyber Security Awareness Month). This was such a good thing that one can argue it ought to be monthly, even weekly.



Security Serious Week engaged leading cybersecurity organisations to share their experience, expertise and resources with businesses and consumers who could make good use of them. There were free webinars, courses and lectures from some of the biggest names in cybersecurity, and as co-founder and managing analyst at IT Security Thing, I put together an **A-Z of data-protection tips** for it. This guide is still available, as a free downloadable PDF from IT Security Thing (itsecuritything.com): click on the "A-Z Tips" link at the top of the page. It felt like such a good idea that I've extended the theme to this *PC & Tech Authority* column, and here are my 15 expert tips to help protect your data.

1 LIE LIKE A BOSS

So-called "security questions" asked of us by sites and services to verify our identity have never been secure and have never really verified anything. Anyone can get lucky by guessing, or search Google or Facebook to uncover your likely place of birth, name of your first pet or mother's maiden name. If you have to play the security questions game then cheat, by which I mean lie, lie and lie again. Invent a different place of birth, an unlikely name for your hamster and an outrageous moniker for your mum. If they sound difficult to remember, store them in an encrypted note alongside your login details in a password vault service.

2 CLOSE THE PATH OF LEAST RESISTANCE

Cybercriminals are lazy and will follow the path of least resistance, and your default settings are open gateways to this path. Do. Not. Do. Defaults. It's that simple, and it applies to everything from your router hardware admin login to your social media account settings.

3 PLAY THE BAD GUYS AT THEIR OWN GAME

Security training doesn't have to be boring. The best security awareness comes from applying the three I's: interaction, immersion and interest. Use



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games such as *Root the Box* (**root-the-box.com**), a capture-the-flag (CTF) game that will teach your tech staff the skills required to crack hashes, to get root and to think like a hacker. Once you can think like a hacker, you can start thinking about how best to defend against them.

4 TAKE THE INSIDER RISK SERIOUSLY

If you accept that people are the weakest link in the security chain, you must also accept that some of those people will be your staff. What trips up many organisations is only considering in-house staff as part of the risk equation, when in fact all staff members are a potential risk. This is especially true when outsourcing data handling, so don't be afraid to ask a potential contractor what staff vetting procedures, awareness schemes and physical access controls they employ. Mitigating risk requires partners to be on the same page.

5 SECURITY POSTURE IS NOT AN INTERNAL-ONLY EXERCISE

It's important that your partners and contractors "get" data security the same way you do: the whole supply chain must figure in your overall security thinking, and unless their thinking is on a par with yours, you're asking for trouble. Sure, you're not responsible for the security policies of other firms, but you are responsible for performing due diligence to ensure they take security seriously enough to do business with. Make sure partners meet your high security standards.

6 RETIRE THE OLD AND INFIRM

Programs that are no longer supported or in use should be retired. Uninstalling programs you don't need and that don't receive security updates reduces the threat footprint available to hackers. If it ain't there, it can't be exploited.

7 ADOPT THE PRINCIPLE OF LEAST PRIVILEGE

POLP isn't a nineties Britpop band, but rather refers to the "principle of least privilege", though it does in fact adopt a "common people" approach to security, namely "never log in with administrator rights unless you're doing administrator things". Taking this approach yields the most security against attacks that seek to exploit the privileges available to them.

8 SHRED THE PAPER TRAIL

While we naturally concentrate on our digital data footprint, there's a danger we might overlook the old-fashioned paper trail. Although "dumpster diving" is no longer so popular

with hackers, your bank statements and other documents provide rich pickings for those who can be bothered to check your bin bags. Shredding any documents that contain personal information is a simple way to stop all but the most determined (and a cross-cut shredder will stymie even them) from getting useful attack ammunition.

9 SCAN YOUR NETWORK FOR FREE

Use the resources available to you, and that doesn't have to exclude those on tight budgets: free tools such as AlienVault's ThreatFinder, driven by the Open Threat Exchange (OTX), scan for compromised systems by comparing log data against a live threat database, while Tripwire's SecureScan will look for hidden internet-facing devices for 100 IP addresses on your internal network.

10 USE HTTPS EVERYWHERE

There's a good reason why commerce sites use HTTPS to encrypt their sessions with a digital certificate. It's because it provides additional protection for your data as it travels between client and server. Not every site will cough up the small additional cost for securing things this way, but you can still use HTTPS everywhere (well, almost everywhere) by using the browser extension of the same name. HTTPS Everywhere is a collaboration between the Tor Project and the Electronic Frontier Foundation that rewrites requests to HTTP-only sites to use HTTPS instead. It's free and it works. Use it.

11 SPRING-CLEAN YOUR DORMANT ONLINE ACCOUNTS

We all have a past, and these days most of it's online in the form of a digital click-trail. Those who would do us harm are always looking for an "in", and that can be made easier by leaving the doors to old accounts wide open. If you've left credit card details on a long-dormant site that's no longer getting security patches, your data is at risk. If you've left personal information and files on services you no longer use, these could also be at risk as you're less likely to check your security status there. Delete all sensitive data from services that are surplus to requirements, then delete the accounts completely. Wiping your digital footprints entirely is all but impossible, but that's no excuse for leaving a trail to your credentials.

12 CLASSIFY IT

Only by knowing the value of all your data – which requires performing

an audit of some kind – will you know which demands the costliest protection and which can settle for less financial investment. The most sensitive data probably shouldn't be stored in the cloud, but locally where you have more control over it. Valuable data must be encrypted, which costs, whereas there's little point encrypting low-value data that's already in the public domain. You won't know what security investment you require until you know your data inside out.

13 TAKE CONTROL OF YOUR KEYS

Letting your cloud provider encrypt your data for you sounds good, until you hear that the powers that be have asked them to unlock it so they can take a look (but you won't hear, because in some cases they're legally restrained from informing you). Keeping control of your encryption keys means no-one can unlock your data unless you hand them over, so at the very least you're still in the "who gets access" loop. Solutions vary from encrypting data before it leaves your own network, from the use of on-premise hardware security modules (HSM) that generate and transfer an encryption master key to a virtual HSM within the cloud.

14 SECURE. AUDIT. REPEAT.

Once you've employed your security solutions through policy, process and practice, you must ensure that it's not merely in place, but actually working as it should. So undertake a security audit, including "fire tests" to check just that. Then repeat every six months to keep on top of things, and incorporate audit recommendations into future policy.

15 POLICY MATTERS

A formal security policy document is essential to underpin your security strategy as, without it, anything you implement will be built on weak foundations and prone to falling over if pushed hard. Take your time and get this policy right: the best plans cover not only data protection, but incident response. Consider this document as a dynamic device that can help understand what security means to your business, and devise a structured, real-world, response using strategic forethought. This policy, no matter how brilliant, is worth diddly squat if no-one reads it, or if everyone reads it but no-one understands it. Indeed, if even one person doesn't understand it, and that leads to a breach, you've failed.

This is why education is so vital. That means educating everyone in your business, from the boardroom to the shop floor. ●



STEVE CASSIDY

"SIMILAR STRANDS OF COPPER MAKE MY SMARTWATCH BUZZ ON MY WRIST AND THROW A PORSCHE DOWN THE AUTOBAHN"

If thinking about IPv4 addresses makes you dizzy, how about the miles of copper wire powering everything from your smartwatch to your car?

In networking, we deal a lot in improbable numbers. People are often stunned that I can remember IP addresses after three or four repetitions, because they're aware of the pub quiz fact that IPv4 has room for four billion public addresses. To me, these addresses are intriguing, peppered with the history of the organisations that had the foresight to grab them. One understands how Bolt, Beranek and Newman are in that list, since they were at the time a large American technology consultancy, but the UK Department for Work and Pensions? Really? Start perusing the ownership, of the list, with great swathes taken up by assorted organisations, and that four billion starts to look as crowded as it is.

I wasn't expecting my trip to Las Vegas, for Software AG's Innovation World, to give me any especially sharp jolt out of my comfort zone when it comes to numbers, and what that actually means for networks and computing. For all those of you who find that IPv4 gives you vertigo, that it's far from being some cosy labyrinth you can solve using fingers-and-thumb maths, here's the idea that gave me that same sense of dread about infinities. Copper wire. Not even buried copper wire, the stuff over which far too many of us still receive our internet service. This was the ultra-fine, ultra-pure stuff that's still used to wind around the armatures of electric motors. If there's any other field that's developed as fast as IT over the past decade, it's electric motors. Whether they're 4mm across (tinyurl.com/juty8ht) for model helicopters, or 130 horsepower (tinyurl.com/owyp9fr) for electric cars, they all use copper wire. I got vertigo while thinking about how similar superfine strands of copper, by passing electric current, can make my Pebble smartwatch buzz on my wrist or throw a Porsche down the Autobahn at 220mph.

In order to do either, the wire must be well made, to a level of consistency that frankly beggars belief. Think about how to instrument a factory full of wire-

"Wire squirts out of the dies and gets wound onto the spools faster than a man can run, all day, every day"

making machines, machines that never stop deliberately. Wire squirts out of the dies and gets wound onto the spools faster than a man can run, all day, every day. Software AG brought the CTO of the wire-makers to their Vegas seminar, and after each flight of fancy from other panel members about "machine learning" or "Big Data" or "customer tracking", he would just say "we make wire". This is the German sense of humour at its best: what that seminar needed was someone to provide an intellectual on-ramp, a way of going from something you can see and feel, right the way up to the leading-edge work being done in data analytics in late 2015.

Once I'd stopped my brain boggling at the relentlessness of that wire-making factory, I began to understand why they'd plonked such a plain and simple example among so many people trying to sound clever about middleware – because that's what Software

AG does. The firm has a variety of database and codebase products that glue together various streams of business data into a coherent workflow. And if that sounds wishy-washy, then that's what I intended – describing their stuff has to stay a bit wishy-washy until a specific client bends it into a shape that they can use. Such loose upfront descriptions are actually symptoms of a healthy consultancy and customisation revenue stream.

You can always guarantee that top-flight pundits will go for the sexy-sounding, even slightly intimidating, attributes of a product portfolio, and so the other panel members (and some of us journalists) wasted no time diving into issues such as how a data space of thousands of stock lines and subtypes drives the demand for artificial intelligence to design the campaigns of discount coupons being printed in American newspapers.

I was only too pleased that, at the end of each of those explorations of how analytics makes for disturbingly well-targeted junk mail, that German industrialist at the end of the table would doggedly say "we make wire". He has, for example, a system that detects changes in the visual representation of the stream of wire – some cameras and software developed by the Fraunhofer Institute (www.fraunhofer.de/en.html), which thankfully do not store a 24-bit JPEG of each 10cm stretch of wire every ten milliseconds. That's just the sharp end of

over 20 different sensor types that sit on his network, reporting on everything that can go wrong with the materials and machinery that spew



< What was a pigeon doing in the middle of a corporate data presentation?



STEVE CASSIDY

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forth all that wire.

Note that isn't 20 sensors, which would be hard enough, but 20 types of sensor. All just watching those millions of metres of wire – how hot it is, how hard it is, how strong against tension, how conductive and how thick. For each 100m length of wire, a summary of those attributes is stored to disk against the event of a warranty or performance claim at some point in the future. Maybe it's just my memories of being the guy with the pager, on call throughout the night, that gave me a special frisson of fear when faced with this 24/7 cascade of information. That, plus the idea that the data generated by those sensors has to be kept, but not really analysed very much – any emergent properties of those wires might not become apparent or be subjected to analysis for many months or years after they leave the factory. If, like me, you find this disturbing and you'd prefer a more familiar, concrete example from our kind of business, then let me discomfort you a little with a secret from Lexmark.

Yes, the Kentucky-based printer manufacturer has need for some heavy-duty database middleware. Not, thankfully, to track their printer parts manufacture and assembly operations (although I'm sure that comprises the same kind of dizzying data abyss as the wire-making factory). Instead, it was there to talk about customer-side printer management. Lexmark makes at least as much money from managing printers installed in businesses as it does from making those printers in the first place and, at first sight, this is reassuringly familiar.

It watches toner consumption, for example, so the replacement cartridge arrives just as its predecessor is about to run out. It implements variable-price contracts, a print-more-stuff, get-a-bigger-bill arrangement. It can figure out whether a business would do better with a different mix of big and small printers, and some of Lexmark's printers are, of course, pretty big. It installs environmental monitors, room-temperature sensors, humidity sensors and all that jazz. This presentation on the vastness of the "Lexmark Printer Universe" was an excuse to show some of the most intricate, over-developed diagrams I've ever seen. Up in the corner of the last diagram was an innocuous, dashed-line box labelled simply "Pigeon".

I couldn't let that go: all that major corporate-type data presentation and then we arrive at "Pigeon". I had to ask, and it turned out that Pigeon is Lexmark's internal codename for its Internet of Things (IoT) traffic gateway product. It seems that a mental image of a system



that flaps about and emits unpredictable squawks best summarises Lexmark's IoT experience to date. This is not reassuring after those millions of miles of copper wire. In fact, it's another data point on the graph, further support for the Software AG team's assertion that the place where dry technical facts, careful budgeting and proposal-writing meet the thousand-yard stare, the sleepless night and the plaintive, emotional board meeting is in that previously calm and unruffled world of middleware.

LONGER THAN A VET

A tip for you data-centre hosting types: if you take a load of journalists around one of your facilities, don't make a big thing out of your "borehole". That tempts too many puns from people contemplating a data centre, which is by definition a place where nothing is supposed to happen (especially while you're wandering around inside it). On this occasion it was Equinix, and if you're curious, its borehole goes down more than 300 metres into the aquifer. If the building experiences outside air temperatures above 20°C, water spouts up from the borehole to be sprinkled over the chiller pipes, up in the roof heat exchangers.

There were a lot of other data-centre facts and figures to toy with during this tour, but, as always, I forgot them and instead listened to the little asides and snippets that the people came out with as we walked around. In this case, I wasn't encouraged to take pictures, and the promised "official" shots didn't make it to us before press deadline, so you'll have to trust me when I say that 6,000 square metres of data centre looks exactly the same whichever floor you

▲ Software AG's Eric Deffaut takes to the stage at Innovation World, surrounded by technology

step out of the lift onto. Of course, for a facility that boasts "five-nines" (that means 99.99999%) reliability, you'd expect that not much would be going on, or at least that what was happening wasn't very physically apparent. Equinix is keen to point out that all of its buildings, new and old, get the same reliability score, even though the older ones are somewhat less energy-efficient than the one with the, um, borehole in the middle of it.

What I was supposed to be there for was the Equinix Apprenticeship Programme, which takes a couple of promising people per year and puts them through a four-year day-release study and work programme, with an NVQ to show at the end of it. Given that this whole programme was put together at Equinix's behest by local colleges, both in terms of the study programmes and the candidate selection process, it became clear that the training to become a data-centre specialist is four years, plus some previous time studying in college on an allied topic. In other words, between five and six years overall, or longer than training to be a vet.

Equinix MD, Russell Poole, was keen to explain that this project had been driven by Equinix, rather than the colleges coming to them, and that it was showing signs of long-term legs for both the apprentices and the business. I counted at least 12 young chaps larking about in that quiet, engineer-like way in the pauses between Russell's speech, the data-centre tour, the cyclical visits to the boardroom for cross examination by



journalists, and the highly unexpected, but obviously very important bit at the end – they cracked open the door of a meeting room with lots of champagne in it, and announced that the apprentices' parents were arriving and would we mind awfully if they kicked us out?

"In the early days of cloud, it was the remote data centre that was thought of as the safe harbour"

Russell explained the hard-nosed business angle. In common with many of the rest of the rack-hosting business sector, Equinix is merciless in chasing down the last microwatt of efficiency and fraction of a penny on overheads costs. However, it is also exquisitely aware that the skills required to get to those profit sources are a very rare resource in themselves. Looking after good technical people is an even rarer skill.

The merciless efficiency mindset tends to lead towards a job market that promotes the narrow and peculiar advantages of a floating, temporary, on-demand workforce. Equinix's discovery, it seems to me, is that by giving in to its distinctly human impulse toward mentoring and educating, it had almost by accident rediscovered the old industrial tradition of apprenticeship – which, as another Equinixer pointed out, was doubly strange since American companies don't think of apprenticeship as a high-status activity, either for the business or for the apprentice.

On the way back from my visit to sunny Slough, I had plenty of time while crawling along the M4 to notice a hoarding advertising Heathrow and its environs as a great place for businesses to set up an apprentice scheme. Pure coincidence, or advert positioning, as my cellphone crawled past, plugged into my car in emergency-satnav duty?

BIG CHANGES IN BACKUP

In the latter part of 2015's fast-moving convention and trade-show season, I'm sorry to say that I managed to stand up a couple of people who are owed an in-print apology. On the occasion I'm most ashamed of, I chatted with the guys from Arcserve when I was strictly supposed to be sitting with Ray O'Farrell, the CTO at VMware. Not regional CTO, not even CTO of one product range, but the CTO. Eventually we sat down and had a reverse interview in which he mostly wanted to know what I thought were the hotspots within the IoT sector – an



odd question from a guy in virtualisation, you might think, but these days that includes networking. IoT looks like an *enfant terrible* when it comes to types, quantities and eccentricities of traffic.

My other excuse is that talking to Arcserve was mandated by its recent amicable split from the Computer Associates (CA) mothership. That's a nostalgia trip for old IT types who cut their teeth (and sometimes ended up grinding them) on Arcserve for Novell. It's also a bit of a criticism of CA as stewards of the brand – but the new team is pretty upbeat. What I mean by "new team" here is, of course, an oddity, because it's the same people who once lived inside the business unit, but with nice new badges on and a bit of money spent on a new logo and some cute products to show off.

Again, that wouldn't be too interesting were it not for the fact that, within a few short weeks, Veritas emerged from the shadowy cloak of Symantec. That's two backup businesses, both of which were takeover targets over a decade ago, suddenly getting the muscle together to stand on their own feet again. Both are doing it on the back of a sharply increased interest in backing things up and restoring them, and both came out with the same nightmare scenario. What if you had to be able to show the lifecycle of a document that had become pivotal in a legal case, and said document was sloppily shared in an online file repository?

Their solutions are related to backup: both will now do a backup appliance that looks suspiciously like an old-school internal file server. These appliances come with a wide range of membership modules for the popular public cloud

▲ Training to be a data-centre specialist takes five to six years – longer than to be a vet

storage services, and can be configured to periodically snapshot the state of your files onto those services, against the chance that the service just loses them (which does happen, as Google users in Europe discovered this year) or, if you prefer, the far more likely situation arises of someone thoughtlessly deleting something they may later wish to rely upon in court.

In the early days of cloud, it was the remote data centre that was thought of as the safe harbour and your local, creaking, ancient and overfilled file server that was the risky one. Now that picture is being inverted, and not because data centres have become more flaky. The main source of unreliability is the sheer spread of different software providers and their enormous variety of ambitions, software development cycles, security procedures, hosting contracts, SLAs and diligence.

The churning marketplace in hot collaboration tools makes the plain old email server of yesteryear look like a cosy, protected backwater. And the people who are bearing the brunt of the bad news when there's a merger or a takedown, or a tornado takes the roof off the hosting company, aren't the vendors of these services, but rather the poor guy who made some sketchy promises about being able to back up and restore all your stuff.

Little wonder both Arcserve and Veritas feel they'd like to have a crack at this extended market without encumbrance, micromanagement or interference. ●



HOW AI AND SMART LIGHTS WILL MESS WITH YOUR HOME LIFE

Is society ready? One alpha tester says no

So-called “futurists” are often maligned, but for Ben Hammersley, deciding to become one meant becoming an alpha tester of what family life might be like in an artificially intelligent connected home. A year in and it is already painfully clear how unprepared many people are to live in close quarters with this type of technology and to accept it as part of their home and family life.

And then there’s a question of whether we should even accept it at all. “As a society, we don’t yet understand how to critique this technology,” Hammersley told CBA’s Wired for Wonder conference. “That’s the real challenge of innovation in 2016.”

Hammersley began his social experiment a year ago by fitting internet-connected lights throughout his house. You’ve probably seen some of the gimmick value of these systems – being able to fade lights up and down using your smartphone, or match inside lighting to outside hues – and

Hammersley has found others. “Last year when I had this thing installed for the first time, I was on a flight from Stockholm to Berlin on Air Norway, and they have Wi-Fi on the flight,” he recalls. “I’d never been on a flight with

“it can’t yet plug itself back in again, so it sort of beeps at you plaintively”

Wi-Fi before, and it was very cool. I had my iPad and I was iMessaging with my wife, and I was also playing with lots of other things on my iPad. And I got a message back from her saying, ‘What are you doing?’ ‘Nothing. Why?’ ‘I don’t know what you’re doing with the lights but [expletive] stop it. It’s like a disco in here!’”

But Hammersley has also discovered a way to use the lighting system to

subtly influence his mind state. He spent “hours” setting up triggers for various lights in his house, “so if you’ve got an email from someone important, a specific table lamp will flash red, and if it’s going to rain the next day, the light next to the umbrella goes green.”

The result, he sees, is he’s developed a kind of “ambient awareness” of things happening in his life simply by being in the house at night. “I know when it’s going to rain, or how full my inbox is, or how urgent a particular work situation is, simply by the colour of lights around my house,” he said. “And after a very short period of time I stopped consciously looking at them but I was just ambiantly aware. I would just walk into the kitchen and the light would be green and I’d be like, ‘Ok, email or whatever. Coffee first’. But it would be an ambient awareness. “And so I’ve become – in some way through those systems – part of the internet. I’m becoming cyborg simply by the lighting in my house.”

Unperturbed, Hammersley added a



➤ The Amazon Echo, a monolithic domestic personal assistant

robot vacuum to the mix and immediately things got weird. "It sits like a little tea tray on wheels and it goes around the house and cleans the floor and then it goes back to its little home, but it can't yet plug itself back in again, so it sort of beeps at you plaintively," Hammersley said. "Now, after a couple of days of this I've started to talk to the robot, because its beeping noise is quite sad. "Then, about a week ago I was walking into my bedroom and I opened the door and the floor cleaning robot was just inside the door, just turning away, and I went, 'Oh, sorry' and shut the door and walked out again. "It's like the most British thing you can do, right? I apologised to the robot. But it's starting to take on a personality, and I'm genuinely worried about the day that it breaks, because one day I'm going to have to bury him."



personality 'Alexa' became part of Hammersley's family life. "I have an infant daughter and I get up every morning, get her out of her cot, carry her into the kitchen, get her milk ready, make a cup of tea for my wife, walk back, and distribute liquids to everybody who wants them," he said. "The point of the Echo is that when I'm in the kitchen with a baby in one hand and a cup of tea in the other and I want to turn the lights off and turn the radio on, and I tell Alexa to do it, it happened. "And then I checked my calendar by asking Alexa what I had on it today, and I remembered I'd run out of cornflakes so I asked Alexa to add cornflakes and more milk to the shopping list, all by talking to the Echo. "I realised that at that point, that was when the future had happened, that I had an artificial intelligence in my house."

Yet Hammersley wound back his use of the technology. Why? Because of the potentially negative influence it might have on his young daughter. "Over the next few years you'll find yourself having conversations with sultry-voiced computer AIs because they're being built into pretty much everything," he said. "One of the things you start to notice, however, is that the personality of that device really does matter."

On this, the Echo is behind other more established personalities like Apple's Siri. "We had an argument in our house about the Amazon Echo because when you're holding your daughter



➤ Ben Hammersley is exploring new ways that humans and machines can communicate

and speaking to the strange box in the corner, you're having a conversation with the wall as far as she's concerned," Hammersley said.

Echo also lacks manners compared to Siri – another reason to wind back its use. "When you say thank you to Siri, Siri says something like, 'No, it is I who must thank you', but when you say thank you to the Amazon Echo, it doesn't reply," Hammersley said. "So I've realised I can't use the Echo in front of my daughter in the same way as I can't be rude to anyone in front of her, because what am I teaching my child as I converse with the robot that's forcing me to be rude to it?"

"It feels weird to be having a conversation on how to talk to the AI that lives in our kitchen in a way that my child won't learn bad manners from it, but it is a situation that is happening right now. "And over the next few years you may get a cool bit of tech which will enable you to have those sorts of conversations and interactions with technology in a much wider context."

For more content like this, do please visit the ACS Information Age website at <https://ia.acs.org.au>

DIGITAL ASSISTANTS FOR THE FAMILY

Where Hammersley has found the most potential for family friction is by using AI technologies like Amazon Echo – a powerful voice command device "about the size of a Pringles can". "Once you get over the creepy thing of a device from Amazon sitting in the corner of the room listening in to you at all times, [it's] kind of awesome ... and has very useful use cases," he said.

Within days, talking to Echo's AI



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